The Blast Furnace and Steel Plant

Steel Production By the Duplex Process

Construction and Arrangement of Duplexing Plant—Consideration of Methods of Operation—Description of Equipment and Hot Metal Mixers.

By J. K. FURST,
Vice President and Engineer of the Pennsylvania Engineering Works.

In these articles we will endeavor to discuss in a brief way the equipment for making steel, which is designated by the trade as the Duplex Process, at its present stage of development.

IN 1916 the total tonnage of duplex steel showed an increase of 92.9 per cent over the production by this process during the previous year. The real worth of the process is now recognized and in accordance with the demand for information and data concerning duplexing, we are publishing a series of articles which will include a description of the construction and operation of duplexing plants.

The first article by J. K. Furst describes the arrangement of a typical plant and deals with the construction of the equipment, particularly hot metal mixers. In later articles the same author will discuss other methods of plant operation and the construction of converters and open hearths. Further articles will appear by prominent metallurgists.

The duplex process was originally tried out in Europe; but, after several attempts, was abandoned as impractical. About sixty years later, in 1904, and we believe without knowledge of what had been done in Europe, it was first tried out in this country, at a plant where the silicon content of the iron ran very high, with a view of eliminating the silicon in the converter, and thus shortening the time in the open hearth. This proved so satisfactory that the duplex process has been an established fact from that time to the present as one of the steps in making steel under certain conditions.

But the steel manufacturers did not accept this fact at the time. While the process was used by a slowly increasing number as time went by, it lagged behind and was looked upon with suspicion by most of the larger manufacturers until the European war broke out in 1914, when the steel producers were called upon for an output greatly in excess of their capacity. Then the real worth of the process was recognized. Large output at minimum outlay of capital and time of installation, and without dependence upon the scrap market were the compelling reasons for its adoption at this time; so that many of the largest producers lost no time in placing their orders for the necessary equipment. Also it is becoming more and more a recognized fact that steel made by this process is of a superior quality. Just recently one of the shell producers made the statement that they have had, to a marked degree, fewer condemnations of shells made from duplex steel than they have had from steel made by the straight open hearth practice. We have not attempted to state all of the reasons for duplexing, as such statements have been made in the past from time to time.

The modern, up-to-date duplex plant consists primarily of two 1,300-tons capacity hot metal mixers, three 25-tons capacity steel converters, three 200-tons capacity rolling open hearth furnaces and one 250-tons capacity hot metal mixer for recarbonizing iron, all electrically operated.

The arrangement of the plant is dependent upon local conditions and the selected method of operation: that is whether the plant is entirely new, which is seldom the case, where the arrangement and method may be selected; or whether it is partly new and partly old, such as new converters and mixers but old open hearth furnaces; or a new plant throughout located in an existing steel making department, all of which has its bearing on the arrangement of the plant. But, roughly speaking, there are two distinct methods of operation employed, as best adapted to existing conditions.

The equipment for both methods being practically the same, the difference in methods resolves itself into the different ways of handling the material between the duplexing units. As stated in the foregoing, there are two of these being employed at the present time.

First.—Handling the materials between the different units exclusively by the overhead traveling cranes.

Second.—Handling the materials between the different units by the overhead traveling cranes in combination with cars and haulage system or electric locomotive.

A typical arrangement of the plant using the former method is shown in figure 1.

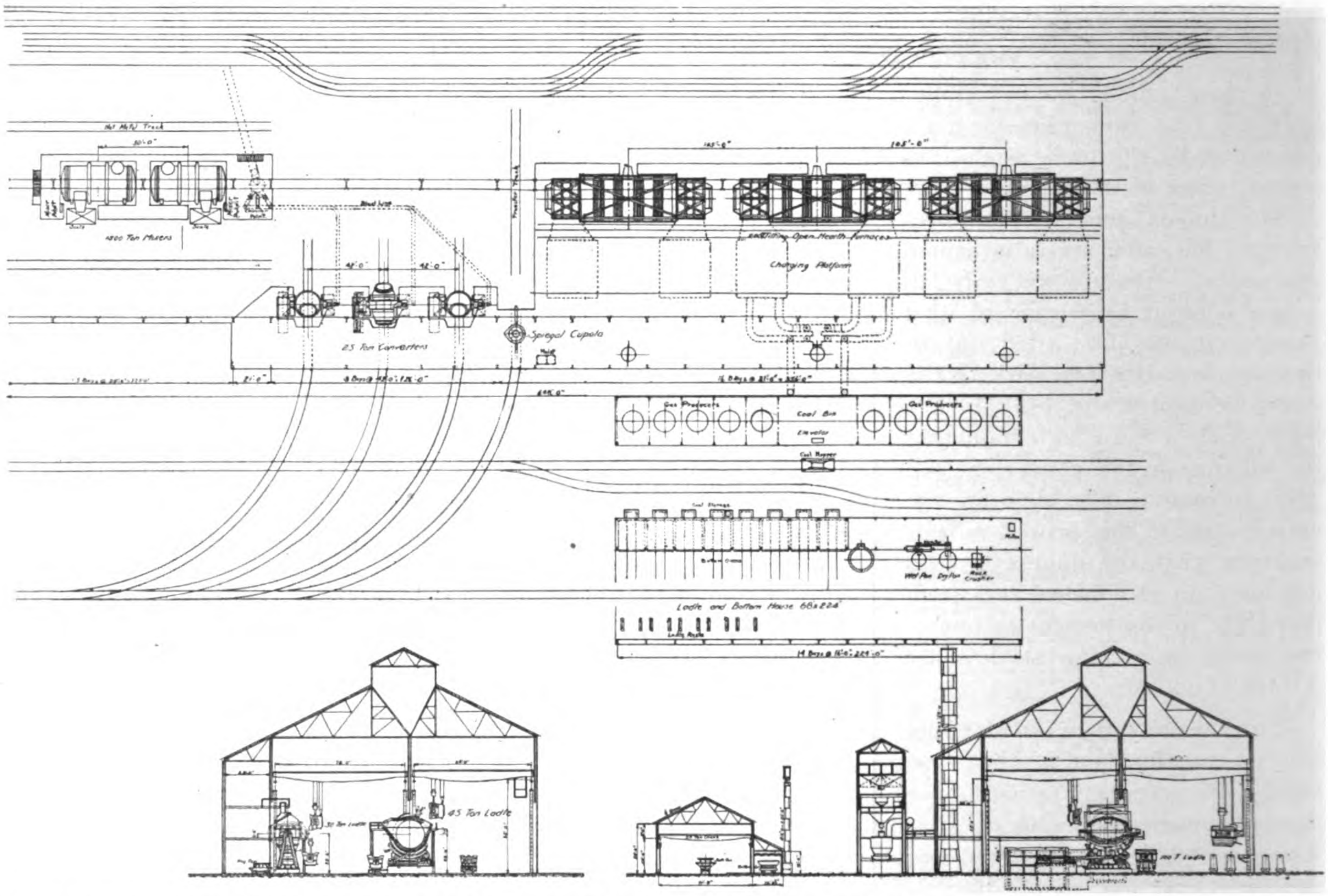

Fig. 1.—Arrangement of typical combination duplex, straight Bessemer, and straight open hearth plant, in which the materials between the different units are handled exclusively by the overhead traveling cranes.

Equipment

The iron formerly came from the blast furnace in a hot metal car the ladle capacity of which ranged from 20 to 50 gross tons. In fact, most of the plants are using such cars to-day. But the modern, up-to-date plant is using a larger car, having a carrying capacity of 60 to 65 tons; with the tendency leaning toward still larger capacity cars. with the view of carrying the total average cast of the blast furnace in one ladle. This car, shown in Fig. 2, carries a ladle having an 11 inch to 13 inch refractory lining on the sides, and a 16 inch to 18 inch lining on the bottom It is equipped with all modern appliances, such as air brakes, automatic M. C. B. couplers, with Westinghouse draft gear and Farlow attachment. The trunnions, side frames and end frames are all steel castings. The car is mounted on either four or six wheel M. C. B. trucks. In the latter case, the trucks are equalized as to loading and the wheels are of either the pressed or rolled steel type. With a car of this character, molten iron is hauled safely at a comparatively high rate of speed for distances as great as ten miles between the blast furnace and the mixer, and at times passing over city streets.

When the iron reaches the mixer, the ladle is lifted from the car by a 100-tons capacity overhead electric traveling crane and poured into the mixer through the receiving spout.

The Hot Metal Mixers.

It will be seen from an examination of figure 1 that there are two hot metal mixers, each having a capacity of 1,300 gross tons, arranged side by side, directly in line with the columns and under the crane runway girders of the middle line of columns of the open hearth building. This is, in the majority of cases, the best arrangement; which permits of the handling of the iron coming from the blast furnaces by a different crane on a different runway from that handling the iron from the mixer to either the converters or the open hearth furnaces, so that there may be no interference between the different cranes, thus insuring continuous operation.

The metal coming from the blast furnace is weighed on the 150-ton capacity track scales located, usually, just inside the entrance to the mixer building. The cars are then pushed up, one at a time, to a position opposite the receiving spout of the mixer to be charged, which brings them under the range of the overhead traveling crane where the ladle is lifted from the car and poured into the mixer.

During the pouring operation, the slag is held back in the ladle by a man on the pulpit adjacent to the receiving spout, by means of a wood block on an iron rod. After the pouring operation, the ladle is emptied of its slag either into a pan on the floor, or into a standard slag car conveniently placed.

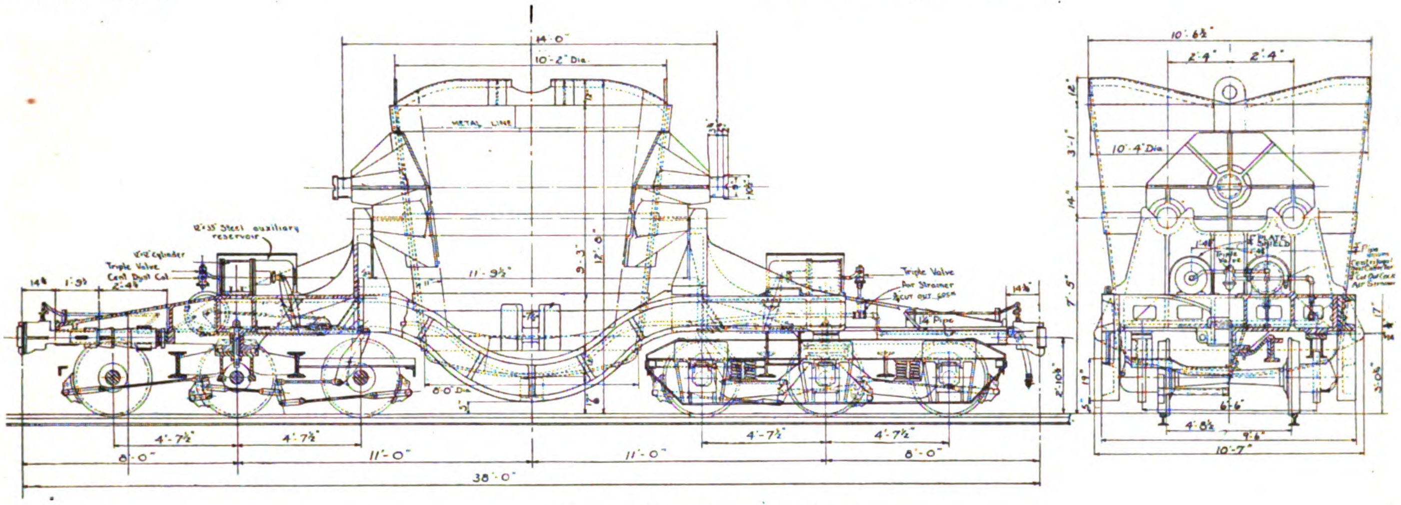

Fig. 2.—60-ton hot metal car.

The two mixers in conjunction, if operated so as to be empty on Saturday, will hold 2,600 gross tons of Sunday iron, thus making a saving of at least $1.00 per ton in normal times, and a much greater amount under present conditions. The metal is poured from the mixer into the 30-tons capacity ladle, Fig. 3, located on the 100-ton scales, one of which is situated on the floor directly under the pouring spout of each mixer. After the metal has been weighed, it is carried to, and charged into, the converters by an overhead traveling crane.

The two hot metal mixers shown in figure 1, are of 1,300 tons capacity each. They are what is known as the Pennsylvania Engineering Works improved type of

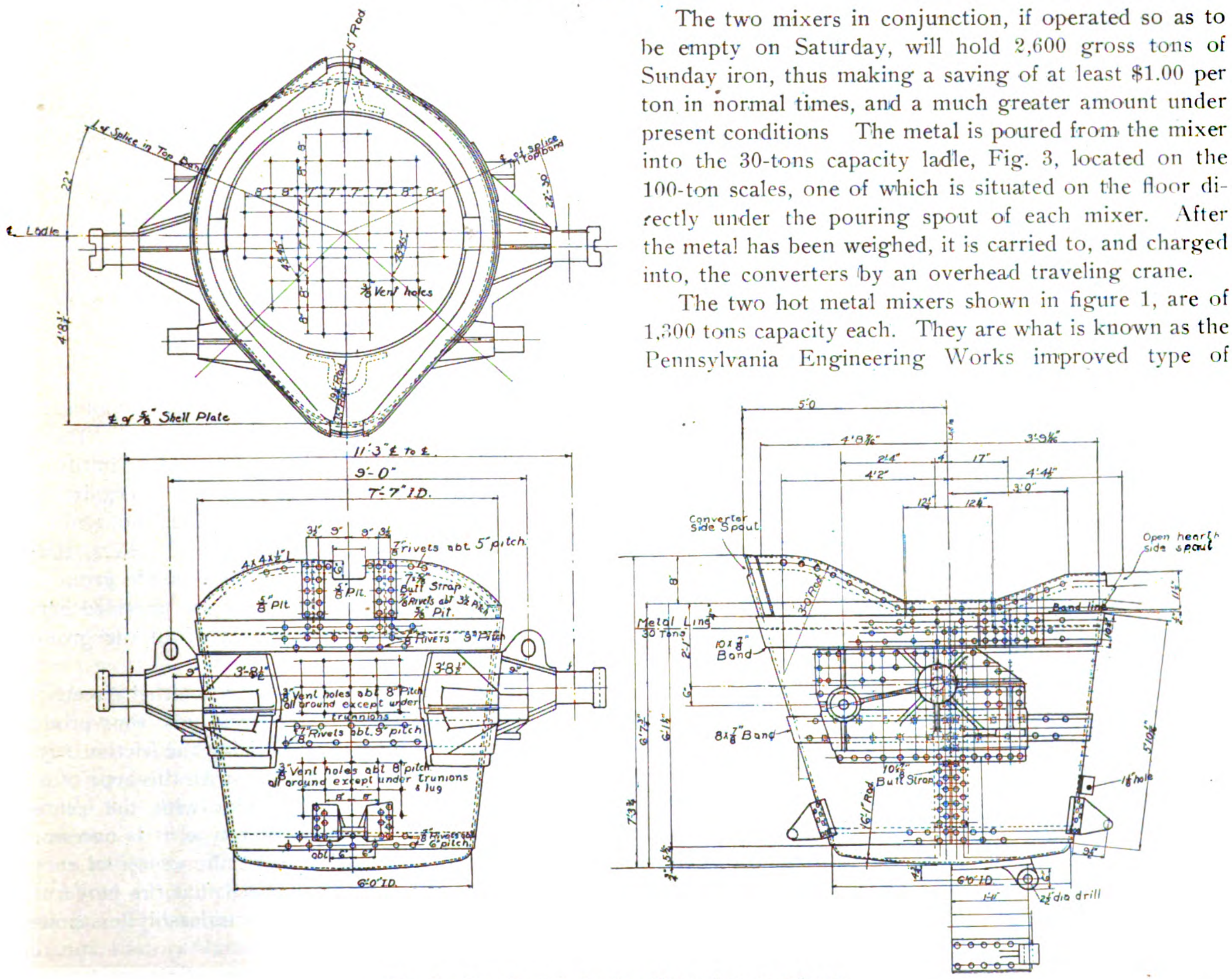

Fig. 3.—Detail of ladle for 30-ton hot metal car.

mixer, placed on the market by the above firm for the first time in the year 1913. Since that time there has been a very large demand for this type of mixer, and there are now, either in operation, or under course of construction, twenty in this country and two abroad. Of the latter, one each in Australia and India. This type of mixer is built by the foregoing company in units of 150, 250, 400, 500, 600, 750, 1,000, 1,200 and 1300 tons capacity.

The mixer is shown in figure 4, and is interesting both on account of its large carrying capacity and its metallurgical superiority over the old type of mixer in use prior to the year 1913, 600 tons being the limit of capacity of the old type up to that time. The old type of mixer, had a comparatively shallow bath of metal, with a large exposed surface (the latter chiefly on account of the large receiving and pouring spouts) with both spouts open to the atmosphere; also a comparatively thin refractory lining, thus permitting rapid loss of heat through radiation, while the later type of mixer, has a comparatively deep bath of metal with small exposed surface, small protected spouts and thick refractory lining, all of which goes to retain the original heat of the metal, 96 per cent being conserved under good operating conditions

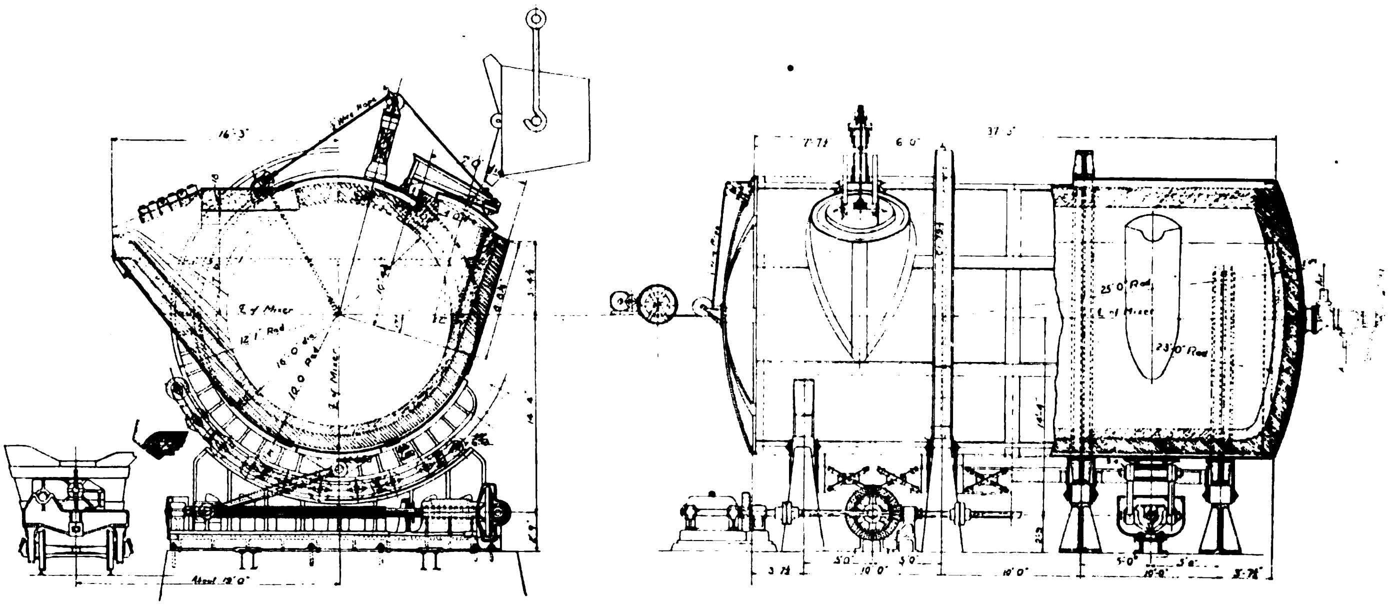

Fig. 4.—1,300-ton hot metal mixer.

On account of the size of the mixer, the metal is retained a very considerable length of time. As a consequence, metal high in sulphur and rich in manganese will show a very considerable reduction in sulphur content.

The mixer consists of a cylindrical shell with spherical ends. It is provided with a receiving spout on one side and a pouring spout on the opposite side. The receiving spout, except when metal is being poured into the mixer, is sealed by a door, which is opened and closed by a hoisting winch operated by a $7\frac{1}{2}$ horsepower electric motor, with brake arranged for dynamic braking. In the later installations, the receiving spout is provided with a cast iron, brick lined cone inserted in its mouth in order to eliminate skulling. Two or more of the cones are kept on hand so that a freshly lined one can be inserted once a week, when the old cone can be removed for relining. This arrangement was first introduced by the American Steel and Wire Company, and is responsible for a considerable saving in the cost of skulling. The pouring spout is closed either by a number of flat brick arches held in steel stirrups, or by a steel casting cover, except a very small opening for the egress of the metal

The cylindrical shell is provided with four cast steel bands spaced uniformly between the two ends. The two outer bands circle the cylinder about half way, while the inner bands form a complete circle, serving the dual purpose of reinforcing the shell and supplying tires on which the mixer rotates on the rollers. There are four groups of cast steel rollers 16-in. in diameter, with 16-in. tread. Each group of rollers is formed into a cradle by means of heavy side bars, with shafts extending through the side bars and rollers, thus insuring equal spacing of the rollers in the group at all times. Two lines of heavy struts are provided between the cradles, to insure the action of all the groups as one unit.

The weight of the mixer is transmitted directly from the rollers to four heavy roller stands, thus producing true roller bearings and minimizing the friction. It may be worthy of mention here that, with this type of mixer, the center of rotation coincides with the center of gravity; whereas, in the former type, it is necessary to lift the center of gravity about the center of rotation, from which it will easily be seen that the modern type of mixer requires, relatively, considerably less power to operate

In order to insure alignment of the rocker stand-

and to tie the mixer more firmly to the foundations, two heavy I-beam girders are provided, extending longitudinally under the rocker stands the full length of the mixer. These girders are provided with shear plates, while the bases of the stands are provided with shear lugs. This feature is also of considerable advantage when lining up the mixer at time of erection.

The 1300-ton mixer is operated by two 75 horsepower electric motors, either of which is capable of furnishing the required power.. The motors are arranged for operation in parallel, and are controlled by full reversing, magnetic switch type controller. The control equipment is so arranged that both motors may be operated in unison, or either motor may be operated from its respective master, independently of the other motor. The motors are placed one at either end of the mixer, and are both connected to a common line shaft.

Refractory Lining.

Prior to the breaking out of the European War in 1914, a 9-inch surface of magnesite brick, backed up by 13½-in. of fire clay brick was used. On account of the high cost of, and difficulty in obtaining, the magnesite, other refractory materials are being tried out. While linings of all fire clay are giving fairly good service, they are not giving all that is desired. Judging from experiments which are being conducted at the present time, it appears that linings of all mica-schist, or a combination of mica-schist and sandstone, will prove superior to anything used in the past. In cases where a combination lining of mica-schist and sandstone is used, the bottom and sides of the mixer, up as far as the slag line, are lined with sandstone; from the slag line up to the skewback for the roof arch, mica-schist is used. The sandstone is laid up with a mortar of ground sand spalls, while the mica-schist is laid up with a mortar made of 75 per cent ground granite rock and 25 per cent fire clay. The joints between adjacent pieces of refractory material are made as close as possible. The ramming up space between the lining and the steel shell is now being filled with insulating material, such as Sil-o-cel or Kieselgor, with satisfactory results.

Rolls for Edging Flat Bar Iron or Steel

Edging Rolls Solving the Problem of Delay in Waiting for Roll Orders—Design of Rolls—Description of Advantageous Operation in Rolling Smooth Product.

By W. S. STANDIFORD.

In any rolling mill, manufacturing flat bar iron or steel, one of the most important and money-saving additions to the roll equipment are sets of edging rolls. Many mills have complete sets of these rolls and realize their value, but in some of the smaller mills, edging rolls are apparently unknown. In these days of strenuous industrial activity with roll foundries so busy with orders that it is impossible to get rolls cast in the rough for making bar iron, delivered in less than three months, after they have been ordered—the use of edging rolls solves the problem perfectly and allows quick deliveries of orders of bar iron or steel, which otherwise would be delayed until the rolls could be received from the foundry and turned in the purchaser's works.

The use of these rolls saves many dollars, as it will allow jobbing mills to fill demands for bar iron or steel in small quantities, in widths of which there is only a small and occasional demand and for which it would not pay to turn a new set of rolls to make the sizes desired. As an example; Suppose a mill had an order for flat bars of iron 2 1/32 of an inch wide by ⅜ of an inch thick, and had no rolls to make them in. The roller would simply put rolls in the housings that contained a 2⅛ in. pass and also the edging rolls and a set of planishers or "bull-heads," as they are termed in rolling mill vernacular. The 2⅛ by ⅜ in. bar would then be put edge-wise while it is hot, in the edging rolls, the bar going through once, (the bar being left sufficiently oversize to allow for shrinkage), then it is turned over on its side and goes once through the planishers. It is then ready for shipping when cold. It is a well-known fact among rolling mill managers and superintendents that rolls generally wear wider at the sides long before the passes (by wear and turning) of the rolls get so small that they have to be discarded and new ones made. When the rolls are worn so that they are ⅛ of an inch wider at the sides and enlarged so that they also make a "fin" on the bar at the joints between the tongue roll in a two-high set, these rolls, although making a bar wider than the desired size, can by the aid of the edgers and planishers or bull-heads, make bars to the exact desired size.

The important part these rolls play in saving money for rolling mill owners will readily be seen from the foregoing, they being of especial value in these days of slow deliveries and railroad embargoes. Having placed before the readers of this magazine the practical advantages accruing through the use of these rolls, I will now take up the constructional details of edging rolls. The rolls illustrated in Fig. 1 are a set

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for edging small flat bars on a guide mill, and the passes are designed to make iron ¼, 5/16, ⅜, 7/16, ½ and ⅝ of an inch thick, the width of the bars being limited to the roll diameter of the train and the amount of play allowed by the housing screws. Edging rolls are also used for making large flat bars on a bar mill. The curves in the bottoms of the passes are purposely shown exaggerated in the photograph, in order to make it clear. Also the full number of passes are not shown for the same reason. The collars of the passes have a taper of 6 degrees, and a depth of ⅜ of an inch, all passes being equal in depth. Many roll turners will disapprove of having all of the edging passes the same depth, the usual practice being to make the smaller ones, such as the ¼-inch wide passes, etc., shallower than the ⅝-inch one. The writer as a practical roll designer, has found out that it pays to make them uniform in depth, as the roller can work with greater efficiency. An example will be given. Suppose that the roller has to make 1⅛-inch wide iron by ¼ of an inch thick, and that a 1¼-inch wide bar is to be used to make the 1⅛-inch one. It frequently happens that the roller has orders each calling for the same width of bars, but each order varying in thickness. By turning all of the passes to the same depth, the roller has only to set the rolls for the one pass, and the other ones will be the same width if the roll turning has been carefully done. The roller will thus be able to get the work out far quicker than if he has to stop and raise or lower rolls for each order of bars having the same width, but variable thicknesses.

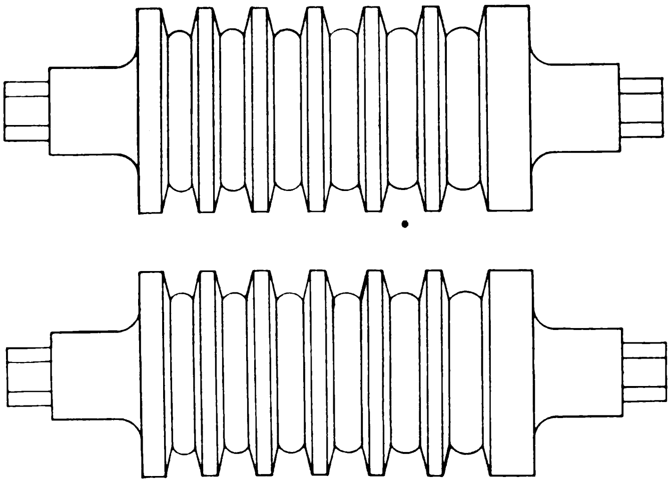


Fig. 1.—Edging rolls.

Efficiency in cutting out unnecessary motion in all trades is the rule nowadays, and nowhere does it show to more advantage, than in the setting of rolls to make small iron or steel bars in the average mill. By referring to the illustration it will be noticed that the bottoms of the passes are rounded or convex. This is done so that the finished bar will have straight sides, as the bull-heads bulge the centers of each bar out. By having the narrow sides of each bar concave as they leave the edging pass, they straighten up nicely in the planishers. In the grooves shown in this set of rolls, the amount of convexity of surface in each pass is 1 1/128th of an inch. Of course, the thicker the bar is made, the more round the surface of the grooves should be in order to counteract the rolling surface pressure of the planishing rolls.

In other words, if a straightedge were placed across the convex surface of each pass; there should be 1/128th of an inch of light between the straightedge and the corners of the passes.

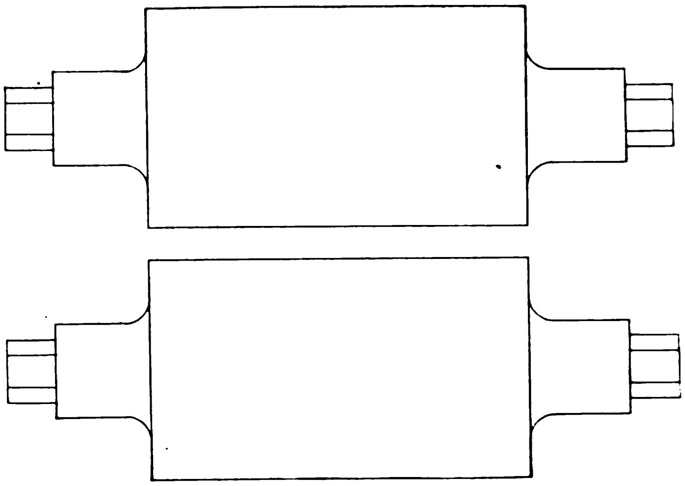


Fig. 2.—Bullheads or planishers.

The edging rolls are usually made of chilled iron and contain as many grooves of varying widths as can be placed in the length of the roll. It is usual to have for guide mills as long a set of bull-heads as can be used in the housings, rolls having a body length of 12 inches or over, coming in handy for the roller. The latter in handling his planishers moves over to a smooth spot when the part he is using becomes rough. So it will readily be seen that it pays to have the planishers with a good body length, inasmuch as it will be a long time before they need dressing in the lathe or grinding machine. The idea being in all cases to keep the rolls working in the housings as long as possible, as long as the passes are smooth. If the finishing flat roll passes are rough, before the bar goes into the edgers, and the edgers and planishers are smooth—the resulting finished bar will be smooth. If the finishing flat roll passes are smooth, and the edgers and planishers rough, the finished bar will be rough. The edging rolls can often be made out of discarded planishing rolls which have a sufficient depth of chill for the purpose, but care must be taken that the two rolls are nearly the same diameter. An allowance of ¼ of an inch difference between the top and bottom rolls is the largest difference in diameter allowed—⅛ of an inch being the usual amount given by roll designers.

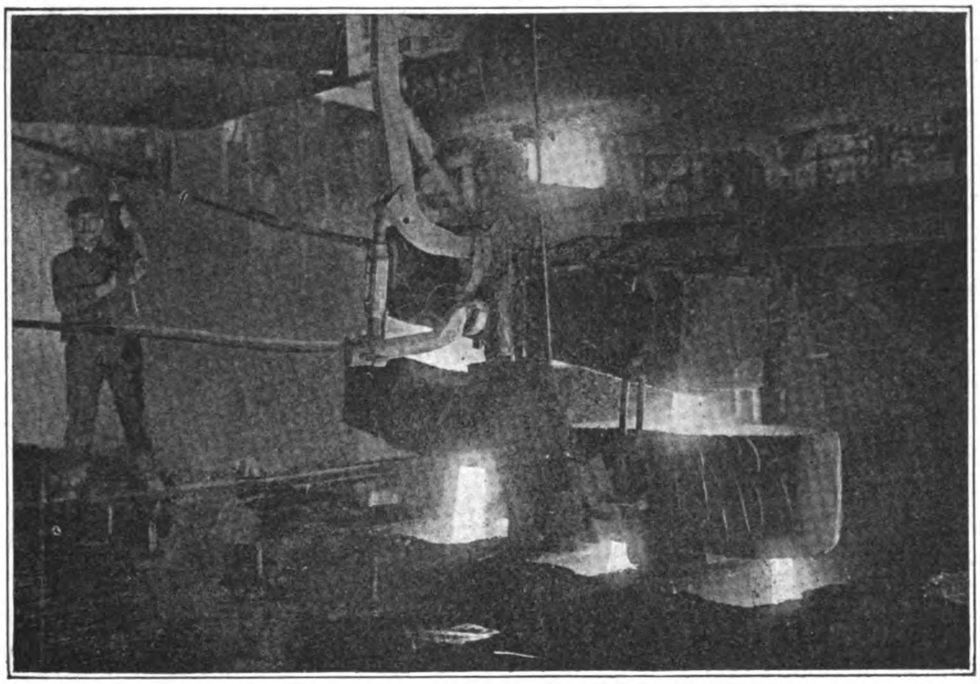
By having the top roll ⅛ of an inch larger in diameter than the bottom one, the faster peripheral speed of the larger roll makes the bar deliver straight,

Ingot Pouring Device Reduces Piping

Quadruple Method of Pouring Ingots Developed at the Brier Hill Steel Company, Youngstown, Ohio, Has Given Good Results in Reducing Piping.

By **ALFRED M. STAEHLE.**

A multiple ingot pouring device which has given good results in reducing piping in high carbon ingots has been developed in the open hearth department of the Brier Hill Steel Company, at Youngstown, Ohio. The ingot pouring device as shown in the accompanying illustration, comprises three steel buckets, lined with a refractory material, which are attached to the ladle with a substantial steel arm. The ladle is placed directly over the ingot molds by means of an overhead traveling crane, as is the usual practice. The bucket unit is not integral with the ladle, but is attached to it from the pouring platform, immediately prior to pouring. The hot metal flows from the ladle into the top trough, through the two lower buckets, thence into the ingot molds, thus forming three separate streams before finally reaching the mold. The openings in the buckets are "spotted" over four molds which are poured simultaneously. Inasmuch as the velocity of flow through the ladle nozzle is the same as in the case of single pouring, the total time required to pour a given number of ingots remains the same, but each mold is filled in four minutes instead of in one minute.



Ingot pouring device used at the Brier Hill Steel Company, which has increased the yield of the open hearth plant 10 per cent. The handles for tilting the buckets are plainly shown.

If the flow through any of the openings is decreased, due to partial freezing, consequently filling some of the molds more rapidly than others, the pouring speed in any combination of molds may be reduced or entirely stopped, by a tilting arrangement which compensates for the difference in flow. Fig. 1 shows the top bucket tilted, thus cutting off the flow of the metal to one of the lower auxiliary buckets, which bucket in turn is also tilted, preventing the flow through one of the nozzles. Thus only one ingot mold is poured as would be necessitated in the event that the other three molds had been filled more rapidly. Figures 2 and 3, show the tilting arrangement applied to filling two and three molds respectively. It is apparent that the metal

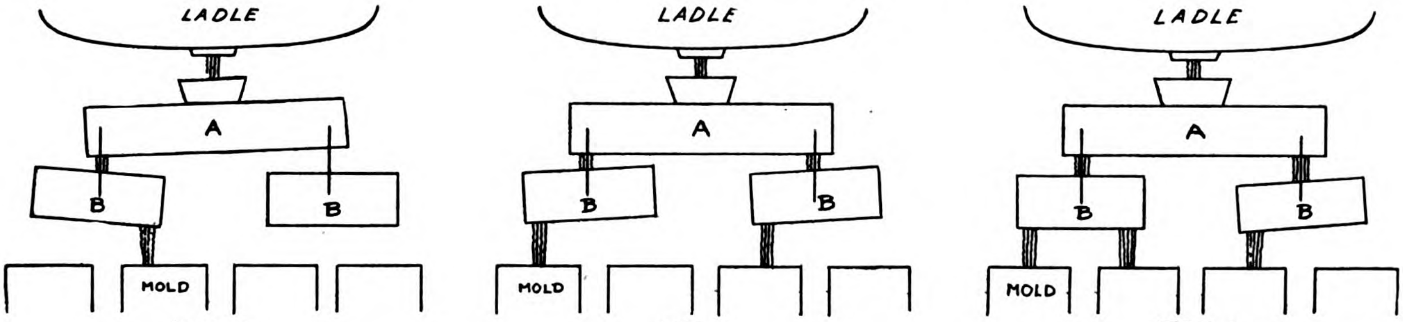


FIG. 1 FIG. 2 FIG. 3.

Illustrates method of pouring one, two and three ingots. Four ingots are poured when all the buckets are parallel.

flows into all four molds when the buckets are parallel.

The ladle nozzle is 1½ in. in diameter and the openings in the buckets are 2¼ in. The lower buckets require new packing after seven or eight heats.

The exposed surface of the running metal being considerably increased the contained gases are given greater opportunity to escape, and the metal reduced in temperature. The ferrostatic pressure head is merely that caused by the metal in the bucket and is therefore considerably less than in the case of single pouring where the pressure head of the entire ladle is applied. The extreme churning action in the mold is thus reduced. The metal in the ingot mold cools gradually from the bottom up, which is a great factor in reducing piping. The device has enabled the pouring of ingots with as high a heat as is required and still resulting in solid ingots. The ingots also have a thick skin, which reduces the danger of cracking during rolling. The percentage yield has been increased about 10 per cent since the installation of this device, which was developed by W. H. Warren, general manager. It is claimed that Brier Hill steel has had 65 per cent less rejection in European factories than other steels shipped from this country.

Elements of Roll Pass Design

Discussion of Seamless Rolling Gives Evidence that Great Tension Is Permissible in White Hot Steel, Free from Flaws, if Lateral Contraction Is Not Hindered.

By **W. TRINKS.**

From roll pass design to the rolling of seamless tubes seems to be a far cry, but study of the following paragraphs will show that there is a close relationship in underlying principles.

In the first installment of this series of articles the problem was broached of how much deformation hot steel can undergo in a pass without disintegration, and the statement was made that further information on that point would be forthcoming in future articles. Mention was made of the fact that permissible deformation is unlimited if the material is above the critical temperature (700 to 900 deg. C. for steel) and if the material is under compression from all sides, but that the permissible deformation is limited if the material is subjected to tension in any one direction.

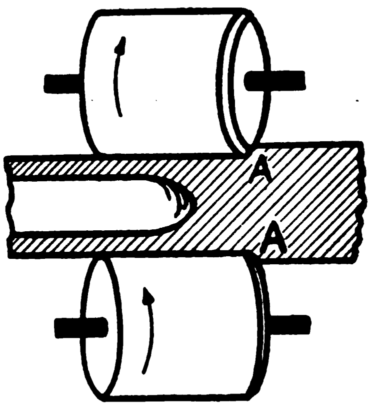


Fig. 1.—Diagram of original Mannesmann process.

Now there is no other rolling process in which the material is deformed so much, and in which so much tension is developed in the material as in the Mannesmann process of rolling seamless tubes. Since the invention of that process dates back to 1887 and 1888, the younger generation among our readers is probably not familiar with it, so that a brief review of its principal features will be appropriate. If two skew rolls act on a bar, Fig. 1, and if the bar be held back, either by the ends of the rolls, at A, Fig. 1, or by a mandrel, or by an obstruction at the rear, friction between rolls and round bar will peel the surface of the latter off the core and will rearrange it in helical form. The skin is "screwed off the core." The action of the rolls can be very much intensified if properly curved cones are substituted instead of the cylindrical rolls, because then the bar can be engaged so that the skin of the bar is actually shoved away from its center line by direct pressure instead of being showed away by friction only. This action will be fully explained in a later article. In either case, the action of the rolls on the material is very severe. The outer fibres are pulled along by friction and are lengthened. Those who have had opportunity to watch a piece of ductile material (steel, copper, etc.) being pulled in a testing machine will remember how it contracts in diameter and finally necks just before rupture. And those who have worked with extremely ductile material such as hot steel, lead, etc., will remember how it pulls out to a point like taffy. Now just the same action (lateral contraction) occurs in the rolling of tubes by the Mannesmann process. Friction lengthens the outer fibers and tends to increase the circumference of the tube. The material contracts laterally, which, in this case, means that it tends to split open in the geometrical center of the bar, and finally does split open. Further lateral contraction reduces the thickness of the wall to that of the finished tube. It should be noted that this deformation is brought about without the use of a mandrel, and that the tubular shape is caused solely by the lengthening and the screw-shaped arrangement of the outer fibers. Tension is, therefore, present to a very large extent in the rolling of seamless tubes by the Mannesmann process, and it is to be expected that troubles arising from

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excessive tension in rolling will show up with particular severity in the rolling of seamless tubes. And they certainly do show up. Wrought iron cannot be used at all, because it tears up along the lines of slag enclosures. The only material which can be used (outside of ductile materials like copper) is mild steel, absolutely free from surface flaws and from occluded gas bubbles. It has repeatedly been said that a seamless steel tube, rolled by the Mannesmann process, is proof of excellent and sound material, for the steel could not have stood the extreme deformation if there had been any flaws in it.

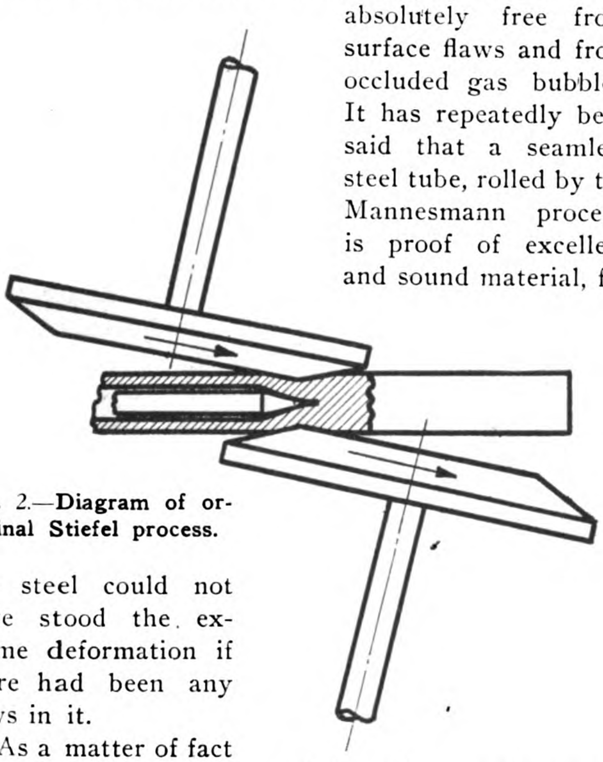

Fig. 2.—Diagram of original Stiefel process.

As a matter of fact the percentage of spoiled tubes was excessively high in the early days of the Mannesmann process and it was this great waste at the Mannesmann works in Landore, Wales, which prompted R. C. Stiefel (who was employed there about 1890 and who is now at Ellwood City, Pa.) to work up a different process for rolling seamless tubes with the avowed purpose of reducing the deformation. In this process, which is illustrated in Fig. 2, two disks with parallel axis work upon the bar which enters somewhat below the center and which, by virtue of such location, is given a forward motion. The action of pulling the skin over the core is still present to some extent, although it is less severe. Formation of the tube is now attained partly by said action, and partly by forcing the bar forward over a mandrel. However, the reduction in the distortion of the material was not great enough to allow the use of ordinary open hearth steel. Even with the Stiefel process the very existence of a seamless tube is evidence that it was made of good material, with the result that the National Tube Company has, on account of certain advantages in the Mannesmann process, gone back, in its latest mills, to a modification half way between the Mannesmann process and the Stiefel process. This decision was partly influenced by the fact that the Steel Corporation has excellent material available now for seamless tubes made with considerable distortion of the fibers

While all this is of general interest, the reader will probably wonder where the lesson in roll design comes in. It comes in from the observation that white hot steel, absolutely free from flaws, will stand a very large amount of tension in rolling, provided that lateral contraction is not hindered. And the steel stands that tension without disintegration, even if the deformation is carried on with considerable velocity. In the Mannesmann process peripheral velocities of 1,000 ft. per minute cause no trouble, if the steel is sound.

We may, therefore, judge that thumb rules on roll pass design, (such as that the entering angle must not exceed 32 degrees, because otherwise the steel is torn, etc.) can be right only for certain conditions of soundness of steel and of temperature. Very hot, absolutely sound low carbon steel will take almost any deformation without cracking.

The truth of this fact is further illustrated by the experience of Dr. Puppe, (the well-known German mill engineer), in the rolling of beam blanks for further shaping and finishing in his universal mill. When he proposed to go into the ingot with a blunt-nosed collar on the rolls as indicated in Fig. 3, all the rollers and roll-turners of the Peine steel works predicted disaster, because only the part section-lined vertically is elongated by compression, while the parts section-lined horizontally have to be pulled along by the center part. Tearing of the side portions was to be the result, in the opinion of experienced rollers. To their surprise no bad effects were noticed. (After every four passes of the nature of Fig. 3, the blank was edged and was given a squeezing pass). The steel being very hot and sound, and the rolling being comparatively slow, no tears of any kind were observed in beam blanks which had been planed open for inspection.

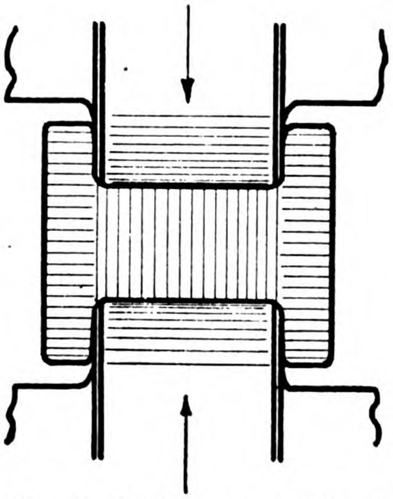

Fig. 3.—Method of producing beam blank contrary to rules of roller.

The lesson of this article is that one may take liberties with the steel if it is very hot, if the deformation is comparatively slow, and if the material is sound.

This is the third of a series of articles on the elements of roll pass design which has been presented by W. Trinks. The other articles dealt with features influencing lateral spreading of steel in the rolls under different conditions of speed, temperature, reduction and shape of pass. The greatest permissible reduction of hot steel was also discussed.

Skip Hoists for Automatic Handling

Classification of Various Types of Skip Hoists—Comparison of Automatic and Semi-Automatic Control—Handling of Coal, Hot Nodulized Ore, Blast Furnace Burden, Ashes and Slag.

By H. V. SCHIEFER.*
Engineer C. O. Bartlett & Snow Company, Cleveland, O.

The skip hoist has long found favor as a machine for handling granular materials. The introduction of the automatic slow down and discharge gave it a permanent place among material-handling machines.

The greatest use of the automatic skip hoist at the present time is the handling of boiler house coal, coke, ashes, in steel mills; limestone, flue dust, slag, in power houses, etc. It lends itself to almost any condition and can be installed at any angle from about 15 degrees up to 90 degrees to the horizontal.

The most serious accident that can happen to a skip hoist is the parting of a cable or the slipping of a brake on the motor, both of which are rare occurances and the result is simply a dented bucket bottom.

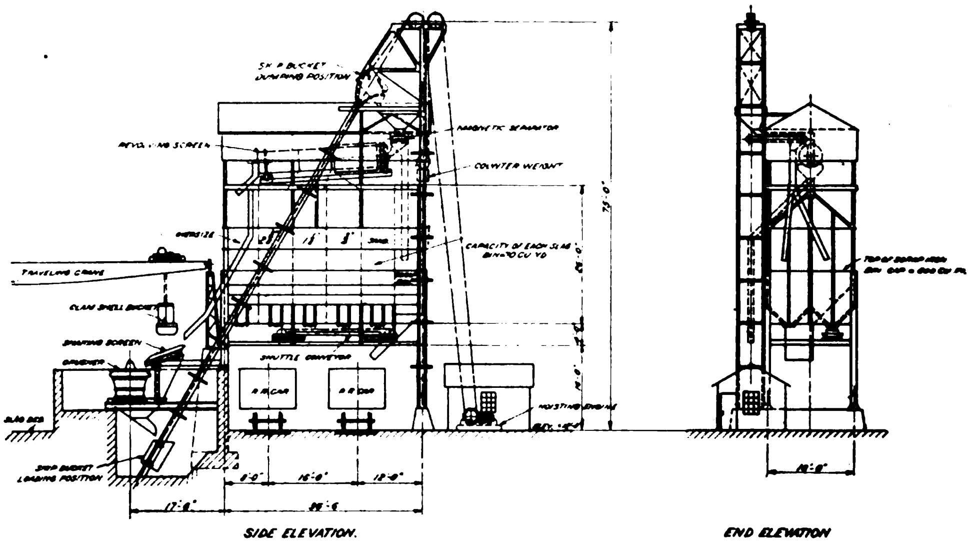

Fig. 1.—Drawing of slag crushing plant in which a skip hoist was successfully utilized.

General Construction.

There are three general types of skip hoist construction, as follows:

1.—One skip bucket with counterweight.

2.—One skip bucket without counterweight.

3.—Two skip buckets in balance.

Practically all skip hoists are included in the above types. Any one of these types allows for the application of entire automatic or semi-automatic control.

Entire Automatic Control.

An entirely automatic skip hoist requires that there be a storage hopper from which the material is delivered to the skip buckets. This storage hopper need not be large. If for example the skip hoist is being fed by a conveyor the storage hopper need be only large enough to hold material from the conveyor until the skip bucket has made a round trip. This may not even be equal to the capacity of the skip bucket. There is no limit as to the other extreme in size. The entire automatic control is most frequently used where the material is of a free, flowing nature and also where it is required to hoist a regular quantity to a given height. It is impossible to get real automatic control handling a material that is sticky. It is absolutely necessary that the material flow easily and quickly through a gate of nominal size. This type of hoist is particularly adapted to such materials as coal, sand, gravel, crushed stone, crushed slag, fine ore, etc., in short, any free-flowing material in which the lumps do not run much over six or eight inches in size for ordinary capacities, say 200 tons per hour maximum. With larger capacities larger lumps can be handled.

The receiving or storage hopper is usually made of steel and when using two skip buckets in balance it requires to be double, each half being fitted with a chute provided with a gate and arranged to deliver into the skip buckets. The gates are so designed that they will automatically be closed except when the skip bucket is in position to receive material. If enough material is contained in the storage hopper to fill the skip bucket, it automatically starts and continues operating until there is not enough material left in the hopper to fill the skip bucket, in which case it automatically stops.

To fully describe the entire automatic system, let us assume first of all that ore is to be elevated from a track hopper by means of skip buckets to an overhead bin. Assume an empty bucket at the bottom under one of the track hopper gates, the companion bucket having been hoisted to the top position in the proper location for dumping. The bucket which is in the lower position will have opened on its downward travel the gate of the chute from the track hopper, thus permitting a flow of ore from the track hopper into the skip bucket.

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* Paper presented at the Cleveland Engineering Society, April, 1917.

As soon as the bucket is sufficiently loaded, its weight raises the counterweight, which automatically closes the gate of the chute leading from the track hopper, thus stopping the flow of ore into the skip bucket. In addition to closing the gate it also operates an electric switch, which admits current to the hoisting engine motor. The skip bucket then starts upward slowly and after a short period of time, by means of the automatic control system, the motor is accelorated and the bucket travels at full speed until it nears the top or dumping position, at which point the slow-down resistance is inserted and at the proper moment the power is cut off from the motor and the solenoid brake applied, thus bringing the bucket to a stop in the dumping position, the other bucket being in the lower or initial position ready to repeat the cycle of operation.

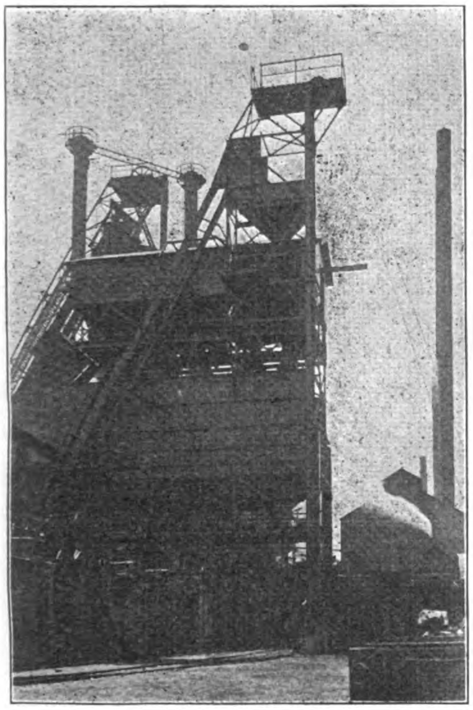


Fig. 2.—Slag crushing and classifying plant in which all material is elevated with full automatic counterbalanced skip hoist.

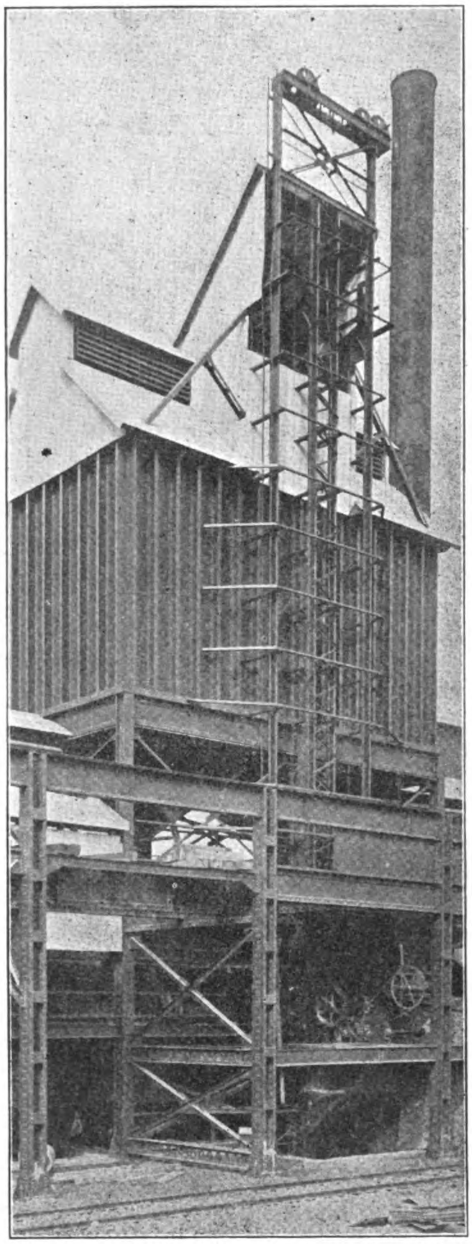


Fig. 3.—Double full automatic skip hoist handling coal from track hopper to overhead storage bins.

In some cases it is desirable to hoist more than one kind of material at different times with the same skip hoist. When materials with widely varying specific gravities, such as coke and ore, are to be hoisted, it is either a case of a full bucket of coke and a very small amount of ore, or it is necessary to shift the heavy counterweight. To overcome this difficulty a lever is employed with an adjustable lever arm. This adjustment can be made easily and quickly by the employment of a hand wheel mounted on a screw provided with a nut onto which is fastened the connecting rod.

Fig. 1. exemplifies a modern plant for the crushing and classifying of blast furnace slag in which an automatic skip hoist receives crushed slag directly from a crusher and elevates it about 70 feet to a revolving screen. Slag is a very abrasive material but can be handled with a minimum amount of wear to equipment by means of a skip hoist. The depth of the pit is very little, if any, deeper than would be required for an elevator or conveyor to do the same work. A photograph of this installation which is at the plant of The Cleveland Furnace Company is shown in Fig. 2. A blast furnace skip hoist shows very prominently in the background.

The double full automatic skip hoist has been used extensively for elevating coal for gas producers, power houses, etc., where there is a large capacity required and a lift of 100 feet or more. Fig. 5 shows in diagram a plant in which run-of-mine coal is received in railroad cars. It is then dropped into a track hopper under which is placed a feeding conveyor that feeds the coal to a two-roll crusher. From the crusher the coal is fed into an automatic skip hoist which elevates the coal to the over-head storage bins.

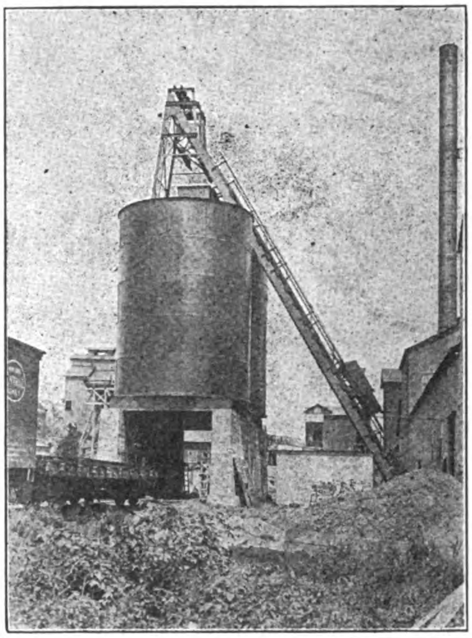


Fig. 4.—Skip hoist handling hot nodulized ore from kilns to overhead storage bins.

Fig. 3 illustrates the first full automatic skip hoist ever built, in which coal is received from a railroad car on an elevated trestle and fed to the skip hoist by a double plunger feeder.

When used entirely automatically the skip buckets are seldom made of a less capacity than two tons each.

They are rectangular in shape, of steel plates ¼-inch to ½-inch with flat bottoms to rest on a counterweighted lever. When handling abrasive materials a renewable lining of steel plates is usually added. Two axles are used on which are mounted chilled cast iron or steel rollers that run in the guides of the skip runway.

The dumping of the bucket is accomplished entirely by the arrangement of the guides on which the skip rollers run. There are two general types of dumping guides: 1st—that type in which all four of the skip rollers are alike; 2nd—that type in which one set of skip rollers has a wider flange than the other set. The first type depends entirely on gravity and the arrangement of the guides to properly discharge the bucket. For the second type, two sets of rails are provided at the top of the runway, one pair for the front wheels of the skip bucket and the other pair of wider gauge for engaging a special tread on the rear wheels.

A typical hoisting engine consists of a heavy structural steel base on which is mounted a cast iron drum connected through a train of spur gears to an electric motor. The electric motor so admirably adapts itself to this type of mechanism that a stream engine has never been used in connection with an entirely automatic skip hoist.

The rope speed is seldom over 200 feet per minute which means a slow speed drum shaft, consequently several sets of gears to get the proper speed from a motor running on an average about 850 revolutions per minute. The frame for mounting these various gear reductions, motor, etc., has passed through the experimental stage and is now made entirely of structural steel shapes properly stiffened and riveted. With this type of frame there is not the possibility of cracking that there was in the older type of cast iron frames. To reduce friction and consequent wear to a minimum, all gears are cut and run in cast iron oil-tight gear cases. A solenoid brake, usually placed on an extension to the motor armature shaft, is used on all engines of this type. The motor is fastened to this shaft extension by means of a flanged coupling, thus permitting the motor to be dismounted and replaced without disturbing the brake or any gears.

The success of the automatic skip hoist depends entirely on the electrical control. The mechanical control is a device for filling the skip bucket and starting the motor only. The major part of the operations of the equipment being performed by the electrical control, viz., accelerating the motor, decelerating, pausing, reversing, etc. The automatic electrical control consists of a plain slate panel supported on a steel frame usually placed near the hoisting engine. On this panel are mounted the solenoid operated primary reversing switches, also the various solenoid operated accelerating switches with their current relays. In the case of alternating current it is interesting to note that the primary reversing switch opens but two of the three phases, this being all that is necessary to reverse the motor. The third phase remains permanently connected to the line.

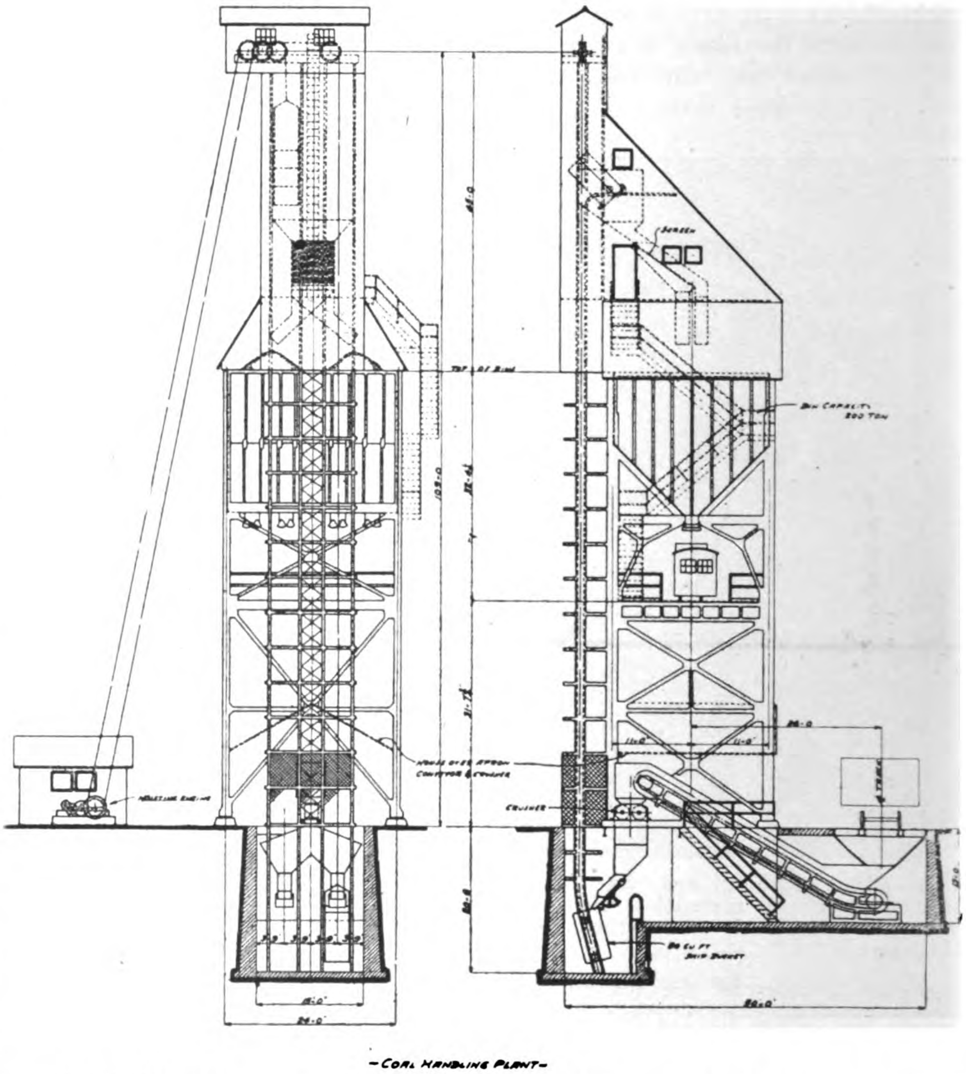


Fig. 5.—Coal handling equipment for handling coal from railroad cars to overhead storage bins.

The accelerating switches automatically cut resistance out of the rotor circuit under control of current relays. The solenoid switches are so designed as to cut one step of resistance out of three phases of the rotor circuit simultaneously, thereby maintaining a proper electrical balance at all times.

The electrical control performs its functions through the use of a specially designed limit switch which is geared directly to the hoisting engine drum shaft through a set of bevel gears. This limit switch consists of a cast iron case in which is mounted a long screw. On this screw is a traveling nut which moves back and forth as the motor is reversed, operating at the predetermined points, sets of contacts, eight in all, four at each end of the limit switch.

At any time that the power is shut off the hoist, either by the control or by accident, a solenoid operated brake is automatically applied. The brake is freed by the raising of a counterweight by an energized solenoid. The brake sets when power is cut from the solenoid.

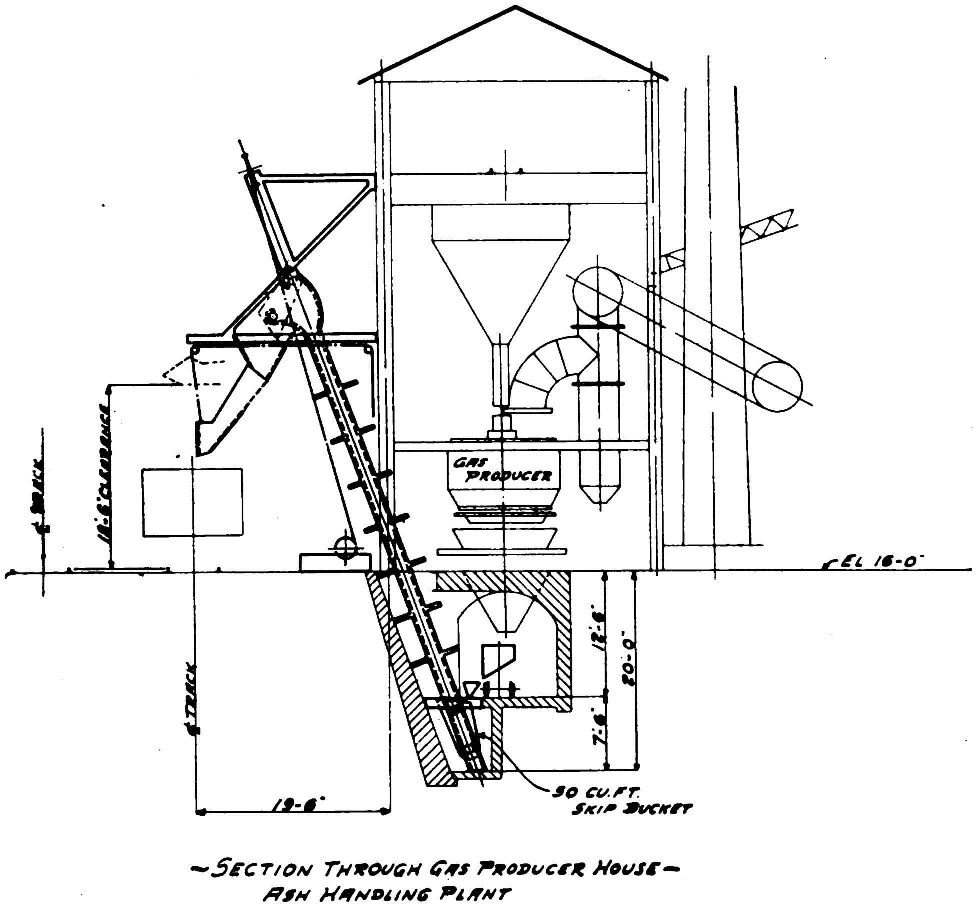


Fig. 6.—Ash hoist for elevating ashes from gas producers to railroad cars.

Semi-Automatic Control.

The semi-automatic control system operates much the same as the full automatic type. It is used only where intermittent service is required or where the material is of such size and nature as to require special consideration at the loading point, and also where it is not convenient to have a storage hopper such as is required by the full automatic type. In order to understand the action of the semi-automatic type, let us consider that ore is to be handled intermittently. Assume the empty skip bucket at the bottom of the skip runway. This is filled with ore from a small car or chute. The starting button is then pushed, whereupon the bucket starts upward slowly and after a short period of time the motor is accelerated, the bucket traveling at full speed until it reaches the upper position at which point the slow-down resistance is inserted and the bucket brought to a stop in the dumping position, where it remains for a period of several seconds to insure the perfect discharge of the material from the bucket. It is then returned to the bottom or initial position by means of a time relay switch in the control system, where it comes to rest and must so remain until the operator repeats the cycle of operation by pushing the starting button. Or as in the case when two buckets are used in counterbalance the pushing of the button starts the same cycle described except that the cycle ends with the stopping of the bucket in the dumping position, there not being required any time relay switch.

Blast furnace skip hoists constitute a large percentage of installations of this type, i. e., push button. More than 100,000,000 tons of ore are hoisted into blast furnaces annually; practically all of which is handled by semi-automatic skip hoist.

Probably the next largest class of semi-automatic skip hoists are those used for elevating ashes into a bin or car. The usual condition is shown in Fig. 6. in which a load of ashes is collected and brought to the hoist in a small car holding one skip bucket load. The man who collects the ashes is a very low priced man and all he has to do is to dump his load of ashes into the skip hoist, press the starting button and go on about his business. The hoist automatically elevates the bucket, dumps the ashes after which operation the empty bucket returns to the loading position.

Fig. 4. illustrates a double entirely automatic skip hoist that is handling hot nodulized ore from kilns to storage bins, operating under the most adverse conditions conceivable. Red hot nodulized ore is discharged from two revolving kilns into a storage hopper provided with two gates in the bottom. When drawing red hot material from the hopper a stream of water is sprayed on it which causes the pit under the hopper to be full of steam and hot water. Any type of conveyor or elevator was out of the question, therefore a skip hoist that is entirely automatic requiring no inspection whatever was installed in the pit.

Open Hearth Furnace of Large Capacity

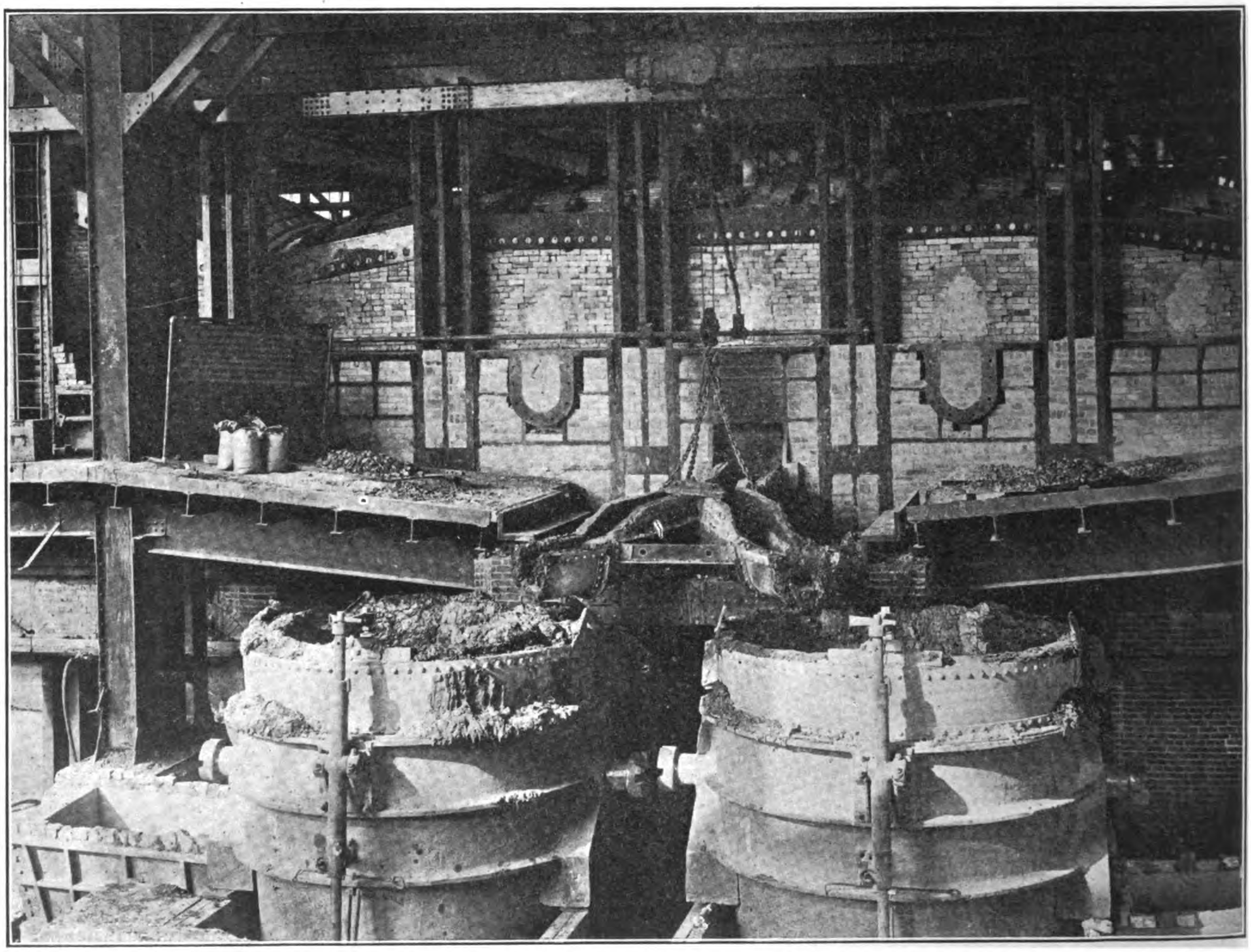
Compact Checker and Flue Arrangement—Heavy Construction and Deep Bath of New 150-Ton Stationary Unit of Central Iron & Steel Company.

By ROBERT H. IRONS.
President Central Iron & Steel Company.

The Central Iron & Steel Company, in the year 1915, made a careful investigation of conditions in their plant with the view of increasing the output by the most economical and efficient means. As a result of this investigation a new and interesting type of open hearth furnace was successfully placed in operation last May, which included the Maccallum patent on flow control for tapping steel into two ladles. This is accomplished by means of the forked runner as is shown in the illustration. The reason for the two-ladle feature was that it could be handled by the present crane and building equipment, whereas a single ladle containing a 150-ton heat would call for enormously heavier handling facilities.

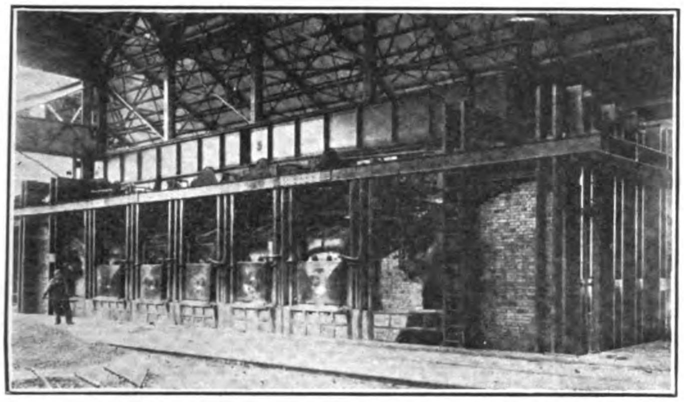
The furnace, which was designed and built by the company's employes, presents some features of particular interest, notably the heavy construction, the great depth of the bath, the long ports, the small gas port areas, and the small checker volume per ton capacity. The buildings, the refractories, the reversing valves, the water-cooled doors and frames and the electric hoists were furnished by outside companies. Practically all other materials were manufactured in the shops and mills of the Central Iron and Steel Company.

The furnace proper is 65 ft. long by 18 ft. wide inside of the binding. The hearth is 41 ft. long by 15 ft. wide. The checker chambers are located to the rear underneath the charging floor. The gas chambers are 20 ft long, 9 ft. wide and 18 ft. deep from the skew of the arch. The air chambers are 20 ft. long, 13 ft. wide and



New 150-ton open hearth furnace of Central Iron & Steel Company, showing forked runner and ladles in position for tapping.

18 ft. deep from the skew of the arch. The checkers proper occupy a space of 2120 cu. ft. in the gas chambers and 3060 cu. ft. in the air chambers. The gas uptakes are 30 x 60 in. Two uptakes, each 38½ x 39 in., furnish the air at either end of the furnace. The gas ports are 30 in. wide, of semicircular shape. The gas port area is 425 sq. in. The air ports are 9 ft. 6 in. wide by 22 in. high making the air port area 2500 sq. in.



General view of open hearth.

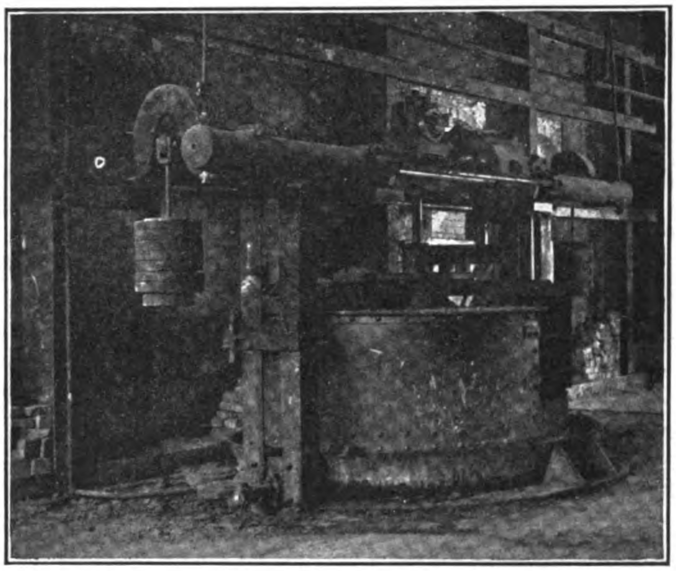
The checker chambers and the slag pockets are covered by steel plates and heavily reinforced by structural struts. The furnace binding is built up of heavy slabs and structural material, and the front and back walls of the furnace are covered by heavy castings to the height of the sill line. There are about 300 tons of steel in the binding of the furnace proper. The Knox cooling system is used except for the ports which are of the company's design. The five furnace doors are lifted by Shepard electric hoists which are mounted between the building columns above the overhead crane runway on the casting side of the furnace. The controllers for these hoists are located next to the lean-to on the opposite side of the charging floor.

The fork runner is handled by a 5-ton Shepard hoist with remote control traveling on a runway underneath the crane girders. To insure the right quantity of steel to each of the two ladles a special flow device is provided. This consists of an arm projecting from the furnace to the bifurcation of the runner. The arm is secured to a horizontal shaft carried by the furnace binding and actuated by two hand levers. A special brick is fitted over the end of the arm which is movable sideways and up or down by the hand levers under the control of one man. The flow of steel in the forks of the runner is regulated by the position of this brick which is introduced as a resistance to the flow in the one or the other fork.

All flues in the open hearth cellar are completely under-ground. They are short and direct and arranged symmetrically about a center line through the furnace and the stack. On one side of the stack the incoming gas is admitted through a down-comer from the overhead main to a flue passing underneath the stack and feeding the furnace. On the opposite side of the stack the burn-out is located connecting this same flue to the stack. A mushroom valve is used to regulate the incoming gas. The burn-out is served by a sliding valve. The reversing valve equipment consists of three Dyblies furnished by the Morgan Construction Company. The two gas valves are situated directly outside the checker chambers. The air valve is located in line with the gas valves and on the center line of the furnace. The valves being close to the checkers chambers the gas losses during reversals are reduced to a minimum. This arrangement also allows ample room for future installation of transportation facilities in the cellar, such as a narrow-gage track system or an overhead runway. Room has also been preserved for installation of waste heat boilers and the whole design of the flues is made with a view to its being readily duplicated on the old furnaces should this prove desirable. The stack is 5 ft. 6 in. in diameter inside of lining and 150 ft. high.

The slag is collected in specially designed boxes into which it overflows from the ladles when the heat is trapped. The filled boxes are placed on flat cars for transportation to the dump. The boxes are dumped by a 30-ton locomotive crane with the aid of a special sling fitting over trunnions provided on the boxes. The flat cars used for transportation of slag and ingots are made by the company. They are built for durability and have proved very satisfactory in service.

On the charging side the installation of the new furnace has made it impracticable to bring all the charges for the furnaces at one end of the building. To overcome this difficulty, a space about 90 ft. wide between the gas producer house and the open hearth building will be utilized as a stock yard with track connections to the charging floor at either end of the building. With this improvement carried out, several complete furnace charges can be stored in the yard and furnaces at both ends of the building can be charged independently of each other.



One of the reversing valves; the heavy checker binding can also be seen.

Electrical Operation of Bloom Shears

Overcoming the Problem of Clutch Design on Large Bloom Shears by Omitting the Fly Wheel and Utilizing a Direct Current Motor Coupled Directly to the Shear.

By G. E. STOLTZ.*
Steel Mill Engineer Westinghouse Electric & Manufacturing Company.

Ordinarily, bloom shears are equipped with flywheels and clutch so that they can be driven by a continuous running motor, the operator merely closing the clutch when it is desired to make a cut. The problem of designing a clutch which will successfully withstand the severe service met with on large bloom shears sometimes becomes rather difficult. In one case, the bloom shear was designed to cut 108 square inches of metal at 1600 deg. F., having a maximum opening of 10 inches. The shear was equipped with an 8600—pound flywheel and driven by a 200 horsepower alternating current wound rotor induction motor. The gear was arranged to obtain 14 cuts per minute. In order to obtain an idea of what success could be obtained by a motor which would start and stop for every cut the flywheel was removed and a 18-horsepower, direct-current motor was coupled direct to the shear. A series of tests were obtained, shearing various sizes of billets. Fig. 1 graphically shows the operation of the shear when cutting five 4 x 4-inch billets at one stroke. During the series of tests, some cuts were made in which six 4 x 4-inch billets were sheared; others, two 6 x 6-inch billets were sheared.

The temporary motor gave satisfactory evidence that the scheme was feasible, so that a 350-horsepower, direct-current, 250-volt motor designed to operate at 175 to 200 revolutions per minute has been ordered to be permanently connected to the shear. With this motor will be supplied the necessary magnetic control which will provide dynamic braking for quickly bringing the shear to rest. It will be noted from the speed curve that the rate of acceleration obtained with the temporary motor is 150 revolutions per minute per second and that the shear is operating at full speed approximately two seconds before the knife touches the metal. The rate of retardation shown is 42 revolutions per minute per second, which will be considerably improved when the permanent motor is installed. The temporary motor is provided with light dynamic braking and solenoid brake, which allows the motor to drift somewhat. The dynamic braking circuit of the permanent motor will be adjusted to obtain approximately the same rate of retardation as is now obtained during acceleration.

The present motor operates at the rate of five to seven cuts per minute, but with the new motor the same output can be obtained as was contemplated when the shear was originally designed. No difficulty is encountered in bringing the motor to full speed before starting the cut, as even with the temporary motor, its full speed was obtained while the knife moved ¾ inch. It will be noted from the current graphic curve that the input drops back to friction load approximately two seconds before the knife starts shearing the metal.

When the new motor is installed, 400 horsepower seconds of energy will be lost in accelerating the shear to a speed corresponding to 200 revolutions per minute on the motor. This will require that the motor be operated at 50 per cent overload for ¾ seconds to bring the shear up to full speed, which is entirely practical. Although this loss is obtained every time a stroke is made, it should be remembered that the shear is at all times shut down when it is not actually required to cut metal. On the other hand, a shear operated by a continuous running motor is drawing energy from the power circuit practically all of the time in order to overcome the shear friction and windage of the flywheel, which in this case, amounted to 50 kilowatts. In other words, the alternating-current, motor-operated shear would only need to run idle for six seconds per stroke in order to dissipate the same amount of energy as is lost in bringing the direct-current motor and shear up to full speed. The delays which often occur in rolling mill practice in almost every case are great enough to make the direct-curent motor operated shear a more economical proposition.

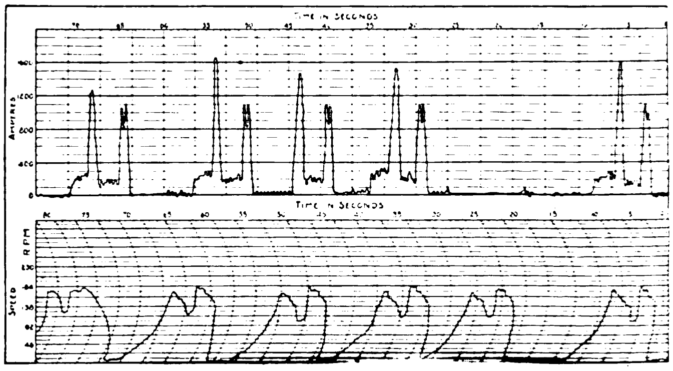


Fig. 1.—Speed and current curves of direct connected motor driving bloom shear.

However, the direct-current motor shear has certain disadvantages, one of which is the increased transforming capacity required in motor-generator sets or rotary converters transforming alternating-current power to low-voltage, direct-current power. This is not any great disadvantage in a large plant as the load is very intermittent and the peaks, such as shown on the graphic curve, are not more than two seconds duration, so that they would diversify with other loads of the substation and would not prove to be a burden. Often when short billets are sheared,the shear is left running continuously so that the starting peaks are entirely eliminated. This would obviate the losses due to acceleration.

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* From a paper entitled "Recent Electrical Applications in the Steel Mill Industry," presented at a meeting of the Association of Iron and Steel Electrical Engineers.

The main feature, however, to be brought out is that if the clutch design presents undesirable features, it is entirely feasible to omit it as well as the flywheel and utilize a direct-current motor coupled directly to the shear. In doing this, no difficulty is encountered in the correct design and successful operation of the electrical apparatus.

Experimental Tests on Silica Brick

Study of the Effect of Degree of Fineness of Material and Pressure—Defects Increasing Failure in Actual Service—Reducing Failures to a Minimum.

By C. E. NESBITT and M. L. BELL.*

The study of silica refractories is receiving more and more attention as shown by the increased number of articles appearing in the technical magazines. The published literature so far has dealt mainly with the theoretical study of the raw materials, while the practical side has received very little attention. Theoretical information is of extreme importance, but its importance is negative until put to practical use. The brick manufacturer is not as a rule a man of theoretical training, hence theoretical investigations to be of use to him must be expressed in simple and explicit terms, easily understood. This does not however excuse the maker, who in most cases has been negligent in regard to investigations of the properties and improvement of his own product. The consumer has also been at fault in that he has not freely coöperated with the maker and informed him wherein the bricks failed. To obtain the best result it is necessary that these three—the investigator, the maker, and the consumer—should work together with heartiest coöperation.

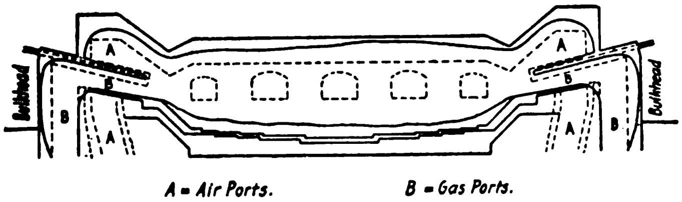

Fig. 1.—Showing ability of silica brick to stand in an open hearth furnace when only a small portion of the original wall is left.

In the manufacture of iron and steel, silica brick find their greatest use in the open-hearth furnace. The demand here is for a brick of high refractoriness which does not become soft or plastic at working temperatures. The silica brick fulfills these requirements in that it is refractory and does not yield to compression unless the stress is sufficinet to crush it. The ability of silica brick to stand when only a small portion of the original wall is left is well illustrated in the bulkheads. (Fig. 1.) This wall when built is 18 in. thick, but wears away in spots to less than 1 in. in thickness and still the brick retains its place.

In the by-product coke industry the development of the use of silica brick is interesting. Formerly a quartzite brick was used which was made of a mixture of clay and ganister. The object of the quartzite brick was to overcome the shrinkage and settling common to fire brick. Some twelve years ago silica brick were used experimentally in both bee-hive and by-product ovens. The experiment proved so successful that their use increased rapidly; not only did their expansion on heating produce close, well-fitting joints and overcome settling difficulties, but their better conductivtiy greatly reduced the coking time.

TABLE I.—TESTS OF SILICA BRICK, ARRANGED ACCORDING TO PRESSURES.

Pressure under which Bricks were made, lb. per sq. in.	Apparent Specific Gravity.	Impact in.	Percentage Spalled.	Slag Penetration, sq. in.		Expansion, lin. in. per ft.
				Open-hearth Slag.	Heating-Furnace Slag.	
187	1.50	47	45.5	3.48	2.28	0.155
500	1.58	46	48.3	3.68	2.42	0.155
750	1.59	60	53.2	3.63	2.41	0.158
1000	1.63	65	51.4	3.79	2.42	0.160
1250	1.65	68	47.9	3.65	2.50	0.155
1500	1.66	65	43.6	3.82	2.50	0.160
2000	1.67	67	44.8	3.64	2.45	0.150
2500	1.68	71	42.0	3.72	2.50	0.160

Tests of Silica Brick.

With a view to studying the effect of degree of fineness of material and pressure, an experimental series of silica brick was made with these two factors as the only variables. A good quality of Pennsylvania ganister was selected and ground dry in three lots to pass a 12, 8, and 4-mesh screen respectively. To the ground material was then added the water and lime so as to give 9 per cent of moisture and 2 per cent of lime. From each of the above meshes standard 9-in. bricks were made on a small hydraulic press at eight different pressures varying form 187 to 2500 pounds per sq. in. The bricks were dried, burned, and cooled, following regular silica-brick practice, and were then subjected to certain physical tests to determine density, resistance to impact, resistance to spall, resistance to corrosive action of slag, and expansion due to heating. A summary of the results is given in Table I, in which the results of the three meshes are averaged according to pressure.

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* Paper read before the annual meeting of the American Society for Testing Materials.

Table II shows the results of the various pressures averaged according to mesh.

Table I indicates that little is gained by increasing the pressure. Table II, however, shows the importance of the selection of mesh. It will be observed that the strength as indicated by the impact test is greatest with the fine-ground material, while the percentage loss by spalling increases with fineness of mesh. Two very important properties in first-class silica brick are the mechanical strength and resistance to spalling; hence from the data we must select a mesh at the expense of one of these properties. More is gained by the coarse mesh,hence we advocate for silica brick a coarse-ground material.

TABLE II.—TESTS OF SILICA BRICK, ARRANGED ACCORDING TO MESH.

Mesh.	Apparent Specific Gravity.	Impact, in.	Percentage Spalled.	Slag Penetration, sq. in.		Expansion, lin. in. per ft.
				Open-hearth Slag.	Heating-Furnace Slag.	
4	1.66	57	30.4	3.92	2.63	0.156
8	1.62	63	47.6	3.67	2.39	0.159
12	1.58	64	63.2	3.44	2.29	0.159

Table III gives the individual losses by spalling for each pressure and mesh.

The average spalling loss for hand-made silica brick is about 30 per cent. From Table III it will be noted that power-pressed silica brick were made with the same spalling loss from 4-mesh material pressed at 1500 pounds per sq. in. These bricks were true to shape, sharp-cornered, dense and had smooth, marble-like surfaces. Molding defects such as soft corners, sponginess, improper slicking, and lack of cohesion were all eliminated. The prospect of the adoption of power pressing as a step towards better and more uniform silica brick was clearly brought out by this series of tests. The idea of power pressing is not entirely new, yet little has been done in a commercial way. One of the large concerns is now manufacturing brick this way on a commercial basis. The average spalling loss of these bricks is 25 per cent.

In actual service, although well guarded as far as practice and construction will permit, silica brick fail from three primary causes: spalling, crushing, and slagging. These cannot be entirely eliminated, but by a deeper study of the manufacturing of brick they can be reduced to a minimum. An ideal brick must be well molded, true to shape thoroughly bonded, and of good mechanical strength.

A visual inspection of almost any shipment will show at least 20 per cent of defective brick. Six shipments of brick of different brands brought out the fact that 60 per cent of the defects were due to molding, 30 per cent to fire cracks, and 10 per cent to improper setting and irregular shapes. These defects can be largely overcome in the present method of manufacture by careful inspection and rejection of the improperly made bricks at certain points in the manufacture.

The ganister must be carefully selected, and sorted; all sock that is soft or which carries considerable iron, clay, sand stone, or other foreign matter should be rejected. The ganister selected should be ground to just pass a 4-mesh screen, care being taken to avoid an excessive amount of finely ground material. To insure uniformity, frequent sieve tests of the mud should be made. To secure a sufficient bond, 1.75 to 2 per cent of lime should be used. In order to avoid irregular shapes and molding defects, 9 to 11 per cent of water should be used for hand-made bricks and the material should be pounded into the mold. The bricks should be thoroughly dried so as to avoid fire cracks when placed in the kiln. Great care should be used when heating, especially during the first part of the burn, to prevent fire cracking; this applies also to the cooling. The bricks as they are removed from the kiln should be carefully inspected and all bricks showing molding defects, fire cracks, and irregular shapes should be rejected.

TABLE III.—LOSSES BY SPALLING, EXPRESSED AS PERCENTAGE.

Mesh.	Pressure under which Bricks were made, lb. per sq. in.							
	187	500	750	1000	1250	1500	2000	2500
4	21.9	34.9	37.9	38.7	31.4	30.4	19.1	29.1
8	51.6	45.9	62.6	51.0	43.3	34.8	38.3	43.3
12	62.9	64.0	59.2	64.4	69.1	65.8	67.0	53.6

The consumer should be allowed to inspect the bricks before they are loaded on the car and a place provided for storage of such brick as he may desire to test.

In the complete report of this paper there appears an appendix which describes the apparatus and operation of all the tests indicated in the above tables. The impact, crushing, spalling, slagging, and expansion tests are all taken up in detail. Sufficient data and methods of procedure are presented to make the process of each test comprehensive.

Lime as a Component of Furnace Slag

Classification of Lime—Features Distinguishing Lime Hot Furnace from Lime Cold Furnace—Properties of Cinder Indication of Furnace Condition.

By **WALLACE G. IMHOFF**

No one thing is more essential to the successful operation of the blast furnace than to know how to handle the lime. The lime serves many other purposes besides simply fluxing the sulphur. Some of its other uses are to flux the silica, to give the furnace heat, to make dry iron and build up the hearth or walls, to make soft open iron, to increase the melting point of the slag, to make basic iron, to form various combinations with the other slag components which will make their removal from the furnace easier.

Lime, in conjunction with other factors in the operators control, may also bear a distinct relation to the quality of the gas, its heating value, the character of the iron, the wind penetration, the driving of the furnace, and the blast pressure. The study of lime and its characteristics, therefore, is of considerable interest in blast furnace operation.

It has been claimed by many furnace men that magnesium limestones give a very nice fluid cinder. A point of discussion not to be overlooked here is the proportion of the components making up the slag. For example the components silica, alumina, lime and magnesium may be in such relation as to make one cinder, very fluid, and another very infusible and thick. Just as an example we will recall the melting points of the various components given in previous articles.

SiO_2	1650° C	1750° C
Al_2O_3	2050° C	
Ca O	2570° C	
Mg O	2800° C	

Now suppose we take 2 slags composed of 10 heats, the first 5 SiO_2, 2 Al_2O_3 and 1 Mg O and the second 2 SiO_2, 3 Al_2O_3, 3 Ca O, and 2 Mg O. It can plainly be seen if both are at the same temperature the first will be much more fluid and look hotter than the second or in other words to have them both look alike in fluidity the second would have to be very much hotter than the first. These slag discussions may seem out of place here with lime but to understand lime one must know slags.

The general classification of lime falls under two distinct headings, hot lime and cold lime. All furnacemen easily detect hot lime and know the conditions of hot lime. Cold lime is not so thoroughly understood. Before entering into detail some of the most striking ways of distinguishing hot lime and cold lime will be discussed.

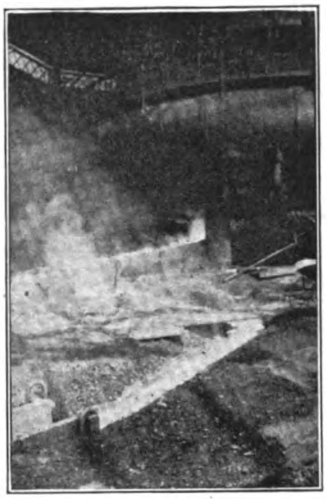


Fig. 1.—Showing fog or fume rising from the running cinder.

The following features are generally conditions found to be present with hot lime and the indications to be seen.

1.—From the cinder (running cold sample) 2.—At the tuyeres. 3—By the furnace driving. 4.—By the iron. 5.—By the charges taken. 6.—By the gas at the stoves and boilers. 7.—By slipping. 8.—By the tap hole flame. 9.—By the slag analyses. 10.—Furnace does not move on stove changes. 11.—Furnace has to be checked. 12—Low tonnage. 13.—Extremely hot furnace. 14.—High top heat. 15.—Black on iron sample top. 16.—Dry tapping hole, (freezes up quickly). 17.—Top flame. 18.—Fusion zone.

The indications of cold lime may be also tabulated in a similar manner.

The main headings for hot cold lime are almost identical although the individual characteristics are entirely different. It is far more difficult to handle cold lime than hot lime for reasons which will be shown later.

Hot Lime.

By "hot lime" is meant a furnace which is extremely hot and carries a large excess of lime. This may be on foundry iron with pyrites ore on the burden, which requires very much lime to flux the high sulphur or it may be on a basic furnace which has too much lime on to flux the silica.

The most reliable source of deciphering the condition of the furnace is from the cinder. Therefore some of the characteristics of the slag will be discussed for the cinder while running and also for the cold sample. The cinder has definite properties which when understood will give plenty of warning to the approach of too much lime. For the purpose of calling these characteristics to notice some definite means of distinguishing them had to be devised or in other words a code had to be made for each peculiarity so that it could be definitely placed and easily recognized again. From such a code the following characteristics have been distinguished for hot lime slag, both when running from the furnace and in the cold sample.

1—Heat. 2.—Fog or smoke. 3.—Sulphur smell. 4.—

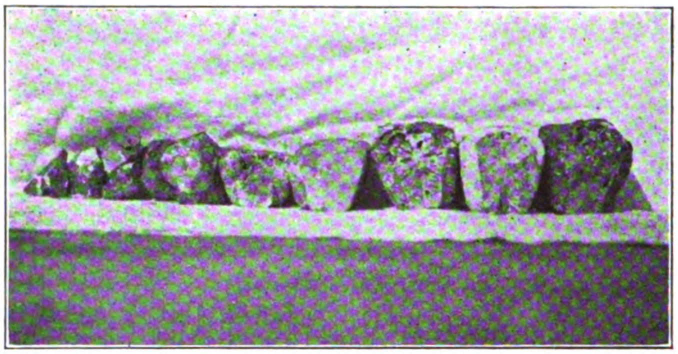


Fig. 2.—Various slag types which were taken under different furnace conditions. The second sample from the right end shows hot lime.

Running of the cinder, etc. 6.—Kind of cinder. 7.—Color of the cold fracture. 8.—Gas cavities in cold samples. 9.—Character of the sample top. 10.—Color of the sample top. 11.—Creep. 12.—Thread. 13.—Hot dipper sample. 14.—Runner crust. 15.—Cross section. 16. Gas flames from the hot cinder. 17.—Appearance of slag. 18.—Indication of lime. 19.—Sample in the test box. 20.—Indications chemically. 21.—Glassy or stony. 22.—Dipper characteristics. 23.—Iron shot.

Heat as interpreted in this table means the actual temperature of the slag. It may be termed white hot, for often when a heavy extra coke blank reaches the hearth with lots of lime the heat of the cinder is intense, in fact so hot that you can not get anywhere near it. Heat may be interpreted in two ways by the actual heat from the slag itself and from the light which is thrown out due to the heat. The latter is plainly shown at night for with an extremely hot cinder the furnace and cast house will be well lighted up and can be plainly seen from long distances Hot lime is therefore accompanied by heat.

On almost all flushes a fog or fume of some kind is thrown off. Fig. 1 shows the fog rising from the slag at flush time. This is a thin blue fog or smoke and shows that there is considerable free sulphur escaping from the cinder. With high sulphur, heavy lime, low fusion zone and heat this fog or fume is given off as white rolls of smoke with practically no smell of sulphur and an extreme smell of lime. This heavy white rolling fume is characteristic of hot lime.

Lean slags generally are accompanied by a smell of sulphur. This feature is only a step in the change from lean slags to hot lime slags. With an increase of heat and lime this sulphur smell becomes correspondingly less prominent until with hot lime slags the fumes may be easily breathed with no particular discomfort.

The running of the slag is another feature influenced by heat and lime. Lean glassy cinder runs like water and it takes but a short time to flush. On the other hand with extreme heat and lime the cinder will not run at all and has to be pulled out in extreme cases with scrapers. Hot lime cinders therefore have the tendency to run slow and be sluggish.

The thickness of a slag is first a function of temperature and then of composition. Figure 2 shows the cold samples of various slags. Those on the left end are somewhat lean and therefore would be thin, those on the right are limey samples and therefore thick. The temperature being constant, silica tends to make slags thin and fluid while lime has the tendency to make them thick and viscous. Obviously this fact is plain since there is almost 1000 deg. C. difference in their melting points.

Under the kind of cinder one may just make a general classification as detected in the cold samples. This would be based on two extremes and a middle, namely, acid, neutral, and basic. These are only for a rough classification. Under such a classification "hot lime" therefore falls under extremely basic.

The color of the fracture depends on a number of things such as heat composition, and slag volume. Figure 3 shows the color to be pure white which is a characteristic color for high temperature. With extreme heat, very heavy lime, and small slag volume the slags are blue gray and will slack to a fine powder if left to the air. Figure 4 shows dark gray samples of hot lime.

It is more common for slag samples to have gas cavities than not. Samples which do not have gas cavities are of two types, the lean glassy cinder and the heavy stony cinder. The first class does not have them for the reason that the cinder is thin and watery and the gas can very easily escape. It is not the fact that the gas is not present but the fact that the gas escapes. In the second or stony type there is a different reason namely a closer equilibrium is established and the sulphur which is the cause of gas cavities is combined with the lime and is in the form of lime sulphide which is disolved up in the slag. As seen from Figure 3 and 4 hot lime samples generally have gas cavities although they may be solid and dense.

The character of the sample top is also represented by two extremes that is by an extremely rounded or arched top, and a deep sag or dip top with all types between. By referring to Figures 2 and 3 it will be seen that hot lime is shown by all gradations of the arched top.

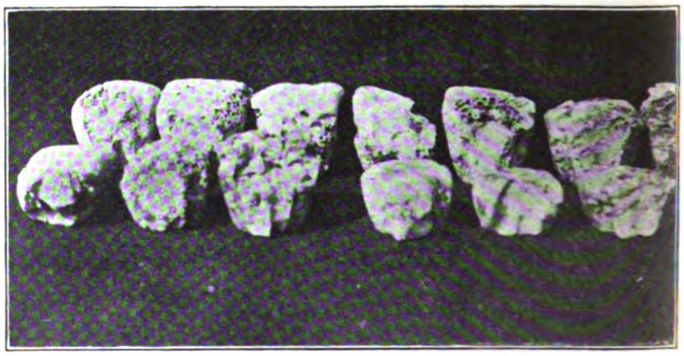


Fig. 3.—Slag samples from a merchant furnace with high sulphur coke and pyrites ore. "Hot lime."

The color of the sample top is also very important for it is a heat indicator. Thus cold samples are black, and hot samples white. With extreme heat and lime and small slag volume the white may be streaked with black. Note the pure white tops of the hot lime in Fig. 3.

The peculiarity called creep is well illustrated in Fig. 5. These samples show plenty of lime but not an excess. Samples of this type are made when an extra coke blank has come down and cold air has been run into the furnace to keep it driving. This creep is due to the escape of gas as the sample cools. Generally lime hot slags do not show creep.

In taking a sample of slag as it runs, lean glassy slags will draw a thin thread when the cinder is allowed to drip on the ground. As the lime increases this tendency becomes less and less until it cuts off short or drops. With extreme heat and lime the dipper becomes covered with a large heavy crust resembling a pie crust. This extreme heavy crusted dipper is characteristic of lime hot slags.

Obviously the same is true of the runner after the flush has been made. A lean slag will leave a small, shallow runner and will be easily cleaned up. lime hot slags are the reverse, the silica which gives fluidity to the slag has been driven into the iron and the slag is extremely dry and heavy and leaves a very heavy runner which at times will take 6 or 8 men the time between casts to clean up.

The cross section of the runner is also an indication of the slag which has just been flushed. Lean slags leave a runner whose cross section would be similiar to that of a pie pan, while hot limey slags leave a runner whose cross section would be deep and narrow like the inside of a cup.

With every kind of cinder the gas flames rising from it have their own peculiarities. The flames from a hot limey cinder are extremely large and broad tappering to a point, while with cold lime they are very small and like the tongue of a snake.

The appearance of the slag is a matter of experience. Some operators don't know a hot-lime slag from a cold lime slag when both are extremely heavy. Cold lime always has a vitreous fracture at the start. This is caused by the loss of silican from the iron and the fact that no silica to amount to anything is reduced. When the lime accumulation becomes extreme the vitreous lustre is lost because there is no silicon to take care of it and the slag becomes dry and heavy.

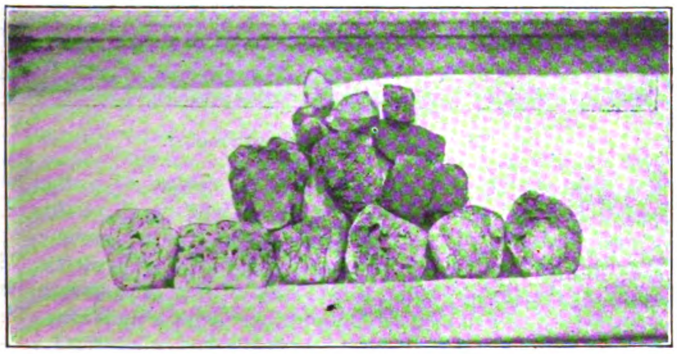


Fig. 4.—Slags gray in color. Extreme heat, heavy lime and small slag volume.

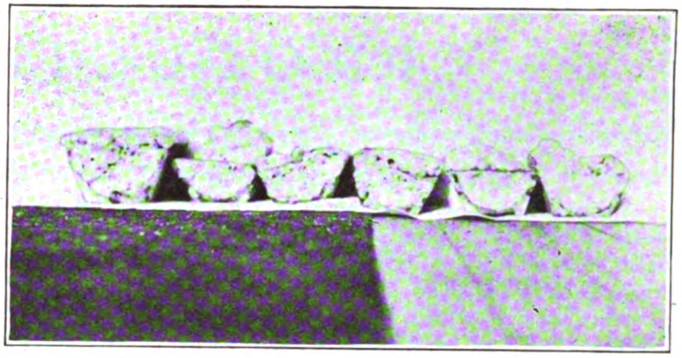


Fig. 5.—"Creep" as tabulated under Number 11. These samples show how the slag has bubbled over the top on cooling.

The indications of hot lime are slow driving dry iron. extreme heat, graphite, and all the slag peculiarities noted.

If the slag is extremely hot and limey it will be hard to knock out of the test box when the sample has cooled. This is because they have better gas held in solution and also because there is very little contraction on cooling. Lean slag will show a deep sag in the top, will contract a considerable distance from the sides of the sample box and will fall out easily when the box is turned up side down.

The chemical indications are based mainly on experience. Under varying conditioins of temperature the lime will seem to automatically increase or decrease due to the loss of silica which has been reduced and put in the iron.

Lean slags will always be like bottle glass, sometimes green and some times brown, and not infrequently black. With the increase of lime such slags which may be called typical lime silicate slags get stony and dense. When such slags are lime hot the stoney lustre gets dull and the color changes to gray and if limey enough the sample will slack when left in the air.

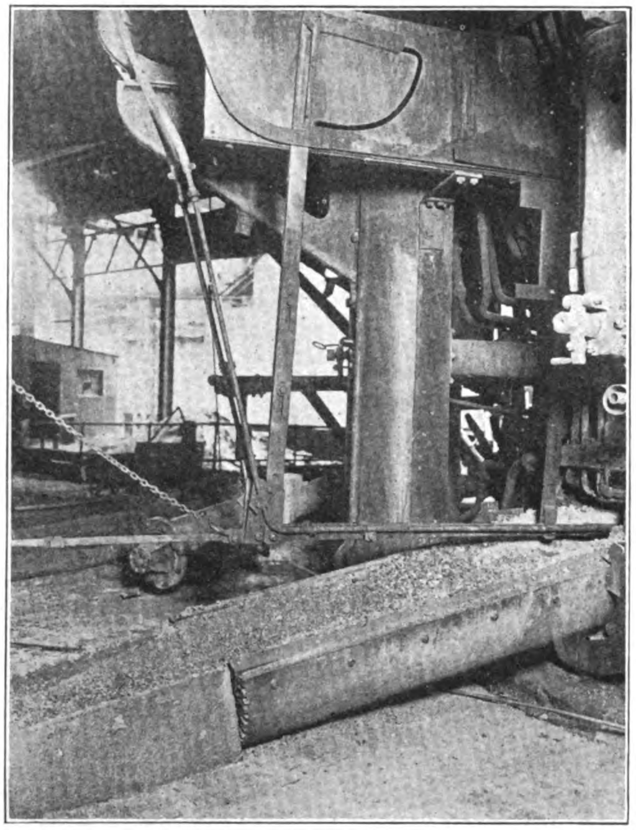
Just as the slag and runner show definite characteristics when a slag is lime hot so do the crusts which are left in the dipper after the sample has been poured. This is a study in itself and like the slag runner a lime hot dipper will be covered with a high heavy dry crust with no gas cavities on the bottom of it.

Iron shot are often caught by lime hot slags due to the fact that the cinder is too thick and viscous to allow them to sink through the day and they are carried out at flush time. Lime hot slags will have a pure white top perhaps full of streaks which are caused by the oxidation of these iron shot which have been carried out and come in contact with the air. Those which have not come in contact with the air may be easily seen as metallic balls and can be picked out by the fingers or by a pen-knife.

PRODUCTION TOPICS

CINDER NOTCH STOPPER.

An invention patented some time ago, relative to a cinder notch stopper by John T. Bates, of Pittsburgh, has been used successfully on several blast furnaces. The stopper which is shown in the accompanying illustration is essentially a safety device, which protects the workman tapping the cinder notch, and permits the cinder to be tapped without shutting off the blast. Both of these advantages are gained due to the fact that the operator need not be near the cinder notch, and in the way of the hot flying cinder when opening or stopping. The apparatus is simple and easily kept in repair. The botting bar has attached to it two levers, one of which revolves about a fixed point, and the other one slides in the groove shown in the illustration. A chain is attached to the first lever which pulls the bar out. The arrangement of the levers imparts to the bar such a motion that the stopper slides into the notch in a perfectly horizontal plane. The chain is usually attached to a winch or winding drum. The stopper returns to the closed position by gravity. The nose of the stopper is water-cooled.



INCREASE IN PRODUCTION OF FURNACE FLUX.

The greatly increased activity in the iron and steel industries in 1916 caused an enormous increase in the quantity of limestone marketed for furnace flux, which amounted to 23,603,508 long tons, valued at $13,936,882, an increase in quantity of 4,604,785 tons, or 24 per cent, and in value of $4,264,535, or 44 per cent, compared with 1915. The average price per ton, according to returns made to G. F. Loughlin, of the United States Geological Survey, Department of the Interior, increased from 51 to 59 cents.

ANNEALING ROLLS WEIGHING FOUR AND FIVE TONS.

It was not so many years ago that practically all annealing was done by the eye of an experienced furnace man. This man became so used to watching furnace heats that it was second nature for him to be able to tell pretty well when the heat was right. The Seaman-Sleeth Company, of Pittsburgh, Pa., have, for the last three years, been giving special attention to this heat control problem in the treatment of semi-steel chill and sand rolls and pinions, and steel rolls and pinions. In each of their large heat-treating furnaces illustrated in Fig. 1, they are using an indicating pyrometer illustrated in Fig. 2, and a recording pyrometer.

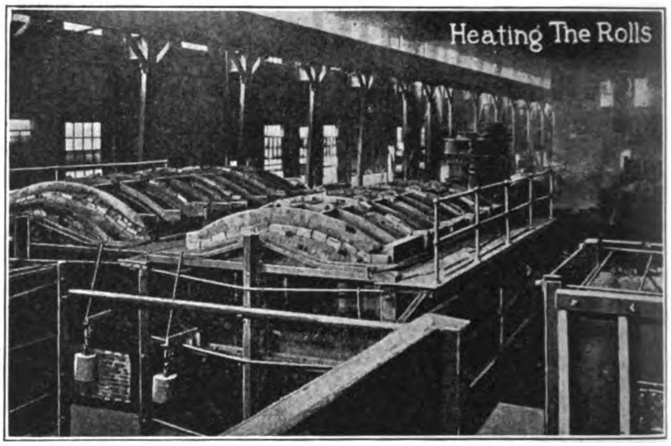


Fig. 1.—Large heat-treating furnaces for rolls.

The fireman can go to the indicating pyrometer and read the temperature of any of the furnaces by simply turning the switch. This is accomplished by means of a thermocouple inserted through the side of the furnace. The thermocouple consists of two elements, which, when exposed to the heat, produce a small electric current. One element is composed of 90 per cent nickel and 10 per cent chromium; the other is 98 per cent nickel and 2 per cent aluminum. The indicating pyrometer is connected to the couple and is so calibered that the temperature indicated is directly proportional to the current produced.

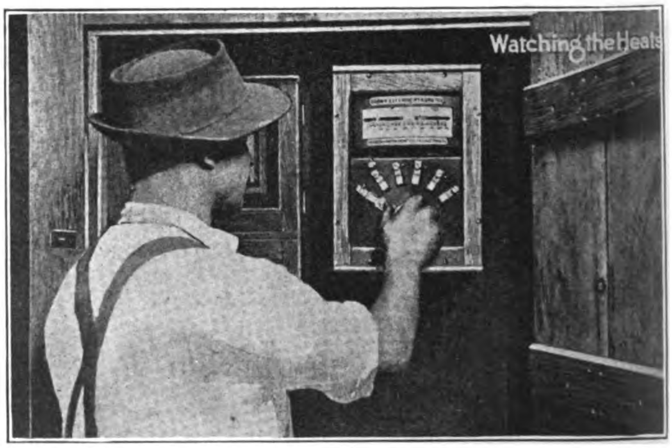


Fig. 2.—Indicating pyrometer.

MOVING A BLAST FURNACE.

For the last four months the Arthur G. McKee & Company have been actively engaged in moving an entire blast furnace plant from Midland, Ontario, to Sault Ste. Marie, Ontario. The original plant was built by the Canadian Iron Corporation on their property at Midland, Ontario, in the year 1908. This original plant included only one furnace stack, cast house and one 20 x 90-foot hot blast stove. The blowing equipment and three small stoves from the original hand filled furnace were diverted to the new stack. The operations continued with this equipment until the year 1911, when the Canada Iron Corporation added three 20 x 90-foot stoves with auxiliary equipment. At that time two Rateau turbo-blowers with electric power plant and new centrifugal pumps, boilers, etc., were installed for use on the No. 2 furnace. This latter installation made the No. 2 furnace completely independent of the old No. 1 stack. This complete furnace plant was purchased this year by the Algoma Steel Corporation, Ltd., of Canada, and the contract awarded for moving this plant in its entirety from Midland to the site of the Algoma Steel Corporation plant, at Steelton, Ontario, near Sault Ste. Marie. This plant has been entirely demolished, and delivered at the new site of erection, and is being rapidly reconstructed at that point. The furnace is being enlarged considerably so that the capacity of the new furnace will be approximately 450 tons of pig iron per 24 hours.

ELECTRIC FURNACE COMPANY FORMED.

T. H. Watson & Company, Ltd., of Sheffield, England, who control the patents of the Greaves-Etchells electric furnace, announce the formation of an American company to handle the furnace business in the United States and Canada. The new company, with Frank Hodson as president and F. J. Ryan as general manager, will be known as the Electric Furnace Construction Company, with head offices in the Finance building, Philadelphia. S. H. Ourbacker, formerly with the Westinghouse Electric & Manufacturing Company, will be connected with the concern as electrical engineer. The Greaves-Etchells furnace has been successful in the Sheffield district and other parts of England, and over 30 furnaces ranging in size from one-half ton to 12½ tons capacity have been contracted for, including special government equipments.

GERMAN ACTIVITIES IN THE IRON AND STEEL INDUSTRY.

A report of a meeting of the German Iron and Steel Institute has reached this country, by means of a translation made by Sir Robert Hadfield, of England. The keynote of the meeting was the conservation of natural resources, means for finding substitutes, plans for technical research and the consideration of after-war conditions. The manufacture of briquettes of mineral wax has served the rolling mills with a suitable lubricant, experiments with "low-temperature tar" have also proven useful. Attempts have been made to replace copper blast furnace tuyeres by iron ones. The Royal Institute for Tests of Materials reported the following concerning the result of experiments with blast furnace slag: "With blast furnace slag, provided that it possesses the properties of that experimented in this instance, a good concrete (rammed and ferro-concrete), and under circumstances even a better one, can be prepared than with gravel material. Iron embedded in concrete prepared with blast-furnace slag behaves in the same way as in concrete prepared with gravel. The slag exerts no direct influence as regards the rusting of irons embedded in concrete." The loss of manganese and iron in slags is also receiving considerable attention.

TEST FOR CARBON MONOXIDE.

Perhaps the best chemical test for carbon monoxide, in that other gases do not interfere and that very simple apparatus is required, is by the use of blood diluted with water to a buff-yellow tint. This test, in the author's experience, is capable of distinctly showing as little as 0.03 per cent of carbon monoxide in the atmosphere. The method of procedure is as follows:

One or two drops of blood from the finger are diluted with water until equal portions of the solutions placed in 100 c.c. test tubes have a buff-yellow color; one of the tubes is taken into the mine, and at the place where the air is to be tested about 50 c.c. of the blood solution is poured out, the mine air taking its place. The tube is then corked, taken to the surface, and gently shaken for 10 minutes. If the air contains carbon monoxide, the pink color caused by the presence of carbon monoxide hemoglobin is detected by comparing the solution with the normal blood solution in the other tube.—U. S. Bureau of Mines Technical Paper 11.—Reported in "Compressed Air."

IRON ORE MINED IN 1916.

The iron ore mined in the United States in 1916 reached a total of 75,167,672 gross tons, the greatest annual output ever made. The shipments from the mines in 1916 were 77,870,553 gross tons, valued at $181,902,277. The quantity mined in 1916 was more than 19,600,000 tons greater than that mined in 1915. The increases in quantity and in value of iron ore shipped in 1916 amounted to about 40 and 80 per cent, respectively. The average value per ton at the mines in 1916 was $2.34, as against $1.83 in 1915. These figures, which were compiled under the direction of E. F. Burchard, of the United States Geological Survey, Department of the Interior, for 1916 only iron ore containing less than 5 per cent of manganese.

CHROMIUM MAGNETIC STEEL.

Due to the fact that tungsten magnetic steel was reaching prohibitive prices some American steel makers have been successfully producing a chrome magnet steel for some time. The Iron Age reports the new steel to be not less than 90 per cent as efficient as the old permanent magnet steel. It is a 0.90 per cent carbon steel containing about 2 per cent chromium, produced in electric furnaces. Magnetically this new chromium steel is equal to tungsten magnet steel in permanence and somewhat lower in residual density. The new steel, however, requires oil hardening instead of water hardening, and is more difficult to machine.

GROWTH OF ELECTRIC DRIVE FOR REVERSING MILLS.

At a recent meeting of the Association of Iron and Steel Electrical Engineers, the growing popularity of electric drive for reversing mills was shown by C. E. Stoltz, who stated that two years ago there were two electrically-driven reversing equipments in operation in this country and one in Canada. To-day there are 21 either in operation or under costruction. The applications of reversing equipment are not confined to reversing blooming mills, which at first seemed to offer the largest field. The Inland Steel Company, Chicago, for example, has installed a 3-high structural mill, which is to be operated by a direct-current motor, employing the Ward-Leonard system of control. The Mark Manufacturing Company, Chicago, is installing the first billet mill which will use this method of electric drive. It will permit of a wide variety of product to be rolled without changing rolls. A 60-inch universal plate mill is the largest equipment which has been purchased to date. It will be required to roll 15½ x 62-inch ingots weighing 19,000 pounds to ⅜ x 58-inch plates.

NEWS OF THE PLANTS

BOOTH-HALL ELECTRIC FURNACE INSTALLATION

The Midland Electric Steel Company, recently incorporated, will put in operation early in October a 1,200-kva, three-ton holding capacity, two-phase, Booth-Hall electric steel furnace, capable of turning out 30 tons of steel per 24 hours, melting and refining cold scrap.

The plant will be located at Terra Haute, Ind., in connection with the Highland Iron & Steel Company, an arrangement having been made for the latter company to roll the product, which will be forging billets four inches square and under.

NEW ELECTRIC FURNACES.

Licenses for the installation of the following Heroult electric steel furnaces have been issued by the United States Steel Corporation:

The General Electric Company, West Lynn, Mass., will install one 6-ton furnace for making steel castings.

The Taylor-Wharton Iron & Steel Company, High Bridge, N. J., will install one 6-ton furnace for making steel castings. This is in addition to one 3-ton recently ordered.

The Crucible Steel Company of America will install one 6-ton furnace at its Park works, Pittsburgh, for making special steels. This supplements several furnaces of the same types already operating or ordered.

The Pennsylvania Engineering Works, New Castle, Pa., will install one 6-ton furnace for making steel castings.

George C. Warner, Fulton, N. Y., will install one 1-ton furnace for making steel castings under the name of a company still to be formed.

KEWANEE PLANT SOLD.

On August 1, 1917, the Kewanee plant of the National Tube Company, located at Kewanee, Ill., was sold to the Walworth Manufacturing Company, and on that date the National Tube Company retired from the fitting business.

CONVENTION OF IRON AND STEEL ELECTRICAL ENGINEERS.

The following is a list of technical papers to be read at the eleventh annual convention of the Association of Iron and Steel Electrical Engineers, Philadelphia, September 10-14:

"Safeguarding Electrical Equipment," Walter Greenwood; "Heroult Electric Furnaces," Walter C. Kennedy; "Factors Relating to the Economical Generation and Use of Electric Power in the Steel Industry," Brent Wiley; "Central Station Power Supply to Iron and Steel Industry," Joseph McKinley and Ray L. Baker; "Electrical Reversing Blooming Mills," Ralph D. Nye; "Electric Drives for Reversing Rolling Mills," D. M. Petty; "Fuel Economy by Coöperation in Establishing a Better Practice in the Operation of Stokers and Boilers," Joseph G. Worker; "Turbo-Generators,' Richard H. Rice; "Manufacture, Selection and Use of Carbon Brushes," E. H. Martindale; "Grab-bucket Coal Hoists Operated by a.c. Motors with Dynamic Braking and Regenerative Braking," James Farrington and R. H .McLain; "Tool Steel Gears and Pinions for Mill and Industrial Service," E. S. Sawtelle.

The Pittsburgh Rolls Corporation has been incorporated in West Virginia to take over the properties of the Seaman-Sleeth Company, recently purchased by William Morris Imbrie & Company.

MINNEQUA STEEL WORKS IMPROVEMENTS.

Considerable construction work is being done at the Minnequa steel plant of the Colorado Fuel & Iron Company. A by-product coke plant is being built and new soaking pits have been completed. The mould yard extension of the open hearth department will soon be ready for operation. In case of all employes who go from the service of this company into military or naval service, either as volunteers or as a result of being chosen by the government, the company will give such employes, on their return, preference over new applicants for employment, and will, as far as possible, place them in their old position or equally good positions with the company.

NEW SHEET PLANT.

The Steel Company of Canada has commenced the erection of a sheet steel plant. A survey is being made in connection with a project for establishing a $2,000,000 coke gas plant. Should this project be carried out, the Semet-Solvay Company will coöperate with the Hamilton By-Products Coke-Ovens, Ltd. It is proposed that the enterprise shall be financed by the local company and operated by the Semet-Solvay Company. About 1,200 tons of coal would be consumed daily and 7,000,000 feet of gas produced daily.

SHEET MILL PLANT BEING ELECTRIFIED.

The Newport Rolling Mill Company, Newport, Ky., is putting up a new machine shop, blacksmith shop and generating room 250 feet long by 80 feet in width, also 108 feet of structural steel and four new 10-ton electric traveling cranes. Contracts have been let for nine additional sheet mills which will be electrically driven. In time the entire plant will be electrified.

CAYUGA TOOL STEEL COMPANY PLANT.

The construction work for the new plant of the Cayuga Tool Steel Company, Auburn, N. Y., having practically been completed, progress is now being made in the installation of the equipment A portion of the plant, which when finished will comprise two 28-pot crucible melting furnaces, two electric furnaces, a hammer plant and rolling mill, is now in operation. Among the officials of the organization are the following: President and general manager, Charles M. Hammond, formerly president of the Halcomb Steel Company, Syracuse, N. Y.; vice president and sales manager, Thomas Towne, who also is vice president and general manager of the Swedish Iron & Steel Corporation and formerly was connected with the Union Drawn Steel Company, Beaver Falls, Pa.; secretary, William J. Henry, who also is president of the Henry & Allen Company, Auburn, manufacturer of drop forgings, machinery, etc.; treasurer, William K. Payne, also vice president of the Cayuga County National bank, Cayuga; directors, including the officers, A. E. Ballin, president of the McIntosh-Seymour Company, Auburn; Charles H. Burke, New York, president of the Swedish Iron & Steel Corporation, and Timothy A. Leary, New York, attorney.

The Bass Foundry & Machine Company, Ft. Wayne, Ind., are building an extensive addition to their plant. They are doing considerable railroad work and this addition will help increase their capacity considerably.

INDUSTRIAL SAFETY

MITIGATION OF INJURIOUS DUSTS IN STEEL WORKS.

The Bureau of Mines, in its efforts to improve health conditions in metallurgical industries is investigating the effects of dust in steel works and has published technical paper 153, which brings out the fact that no health hazard is of greater importance than that of dust-laden atmosphere. This has become so generally recognized that many life insurance companies refuse to accept as risks those engaged in the so-called dusty trades.

The investigation has resulted in the following recommendations being made for the abatement of the dust hazard:

Dust originates when the furnace stock is drawn from the bins into the skips. All employes about ore bins, the so-called "back-gang," are exposed, but those particularly liable to be affected are the men operating the skips or the larry cars. Although judiciously sprinkling the stock with water may lessen the dust, sprinkling can not be done in a manner continually or entirely satisfactory. The relation between such wetting down and the amount of dust suspended in the air is clearly shown after rain or snow. Men employed at the bins should be furnished respirators and be required to wear them. In addition, provisions should be made for ample natural ventilation. At some bins an exhaust system would do much to remove dust.

Graphite dust arises mainly during a cast. As the total time of casting is small in comparison with the time the men are on duty, and as the casting house, being large, high, and open on two or more sides, usually has ample natural ventilation, it is improbable that dust is a health hazard of much importance about the furnace. Moreover, nothing can be done to prevent the formation of graphite or its suspension in the air.

Ordinarily, the men employed at the stoves are not exposed to much dust, but all precautionary measures against it should be taken while the stoves are being cleaned or repaired and when the dust catcher is being emptied. Respirators should be required, and as an additional safeguard the dust should be well sprinkled with water.

Men employed about washers and blowers may occasionally be exposed to large amounts of dust, and to meet this condition they should be required to wear respirators. Also, the dust should be wet down.

As the dolomite shed is sometimes filled with a cloud of dust effective measures of mitigation are most urgent. Much of the dust originates at the grinding machine. To avoid pollution of air in which men are working, the machine should be placed elsewhere, or should be entirely inclosed and an air-exhaust system installed for removing the dust of grinding. Dust also rises into the air while the calcining furnaces are being charged. It is believed that the exercise of more care by the crane operator when dumping the dolomite into a furnace would do much to abate dust. In addition, all employes in this department should wear respirators. As a health hazard, the dust in this department has other injurious effects than those to the respiratory tract. The calcined dolomite contains much free lime which when moist irritates the skin and the mucous membranes exposed to it. This dust frequently accumulates in the clothing and on the skin. When warm weather or hard work makes men perspire freely the skin is irritated, becomes painful, and a serious condition may result. It is important to have this department equipped with ample washing and bathing facilities and to require the men to bathe thoroughly after each turn of duty. In addition, they should gargle water, douche the nose, and wash the teeth in order to clear away any dust. Another important facility that should be provided these men is a clothes locker, which should be dust proof if it is to be in the dolomite shed. Men employed in the shed should put on clean underclothing and socks each day, and to encourage them in doing this facilities such as wash sinks, hot water, soap, and drying racks should be supplied.

The reduction to a minimum of dust in the rolling mills should receive attention. As the points of origin of this dust—at the rolls—are comparatively small, preventive efforts can be concentrated. It is believed that a fine water spray falling with force just beyond the place where the dust begins to rise would prove effective. Water sprays are now used to cool the rolls, and little difficulty or extra labor and expense should be needed for placing the additional spray. If wet down in this manner the dust would fall with the roll-scale into the scale pit, whence it could be subsequently removed.

In addition to the soot, coke dust becomes suspended in the air as a result of the operation called bottom making, during which finely divided coke is thrown into the pits. The only way to mitigate the dust hazard is to require the men to wear respirators.

The abatement of soot and dust from soft coal fires has received much attention lately and has been discussed at length in publications of the Bureau of Mines. In a steel plant, dust from this source can be greatly reduced and practically eliminated. With substitution of gas and coke for soft coal in furnaces and dinky engines, and with more care to insure complete combustion, and other improvements in methods of firing, this objectionable feature will disappear.

In the Bessemer department attention should be given to preventing dust suspension at the grinding machines in the converter repair shop. The comment on measures demanded at the dolomite shed is applicable to this department as well.

SIXTH ANNUAL SAFETY CONGRESS.

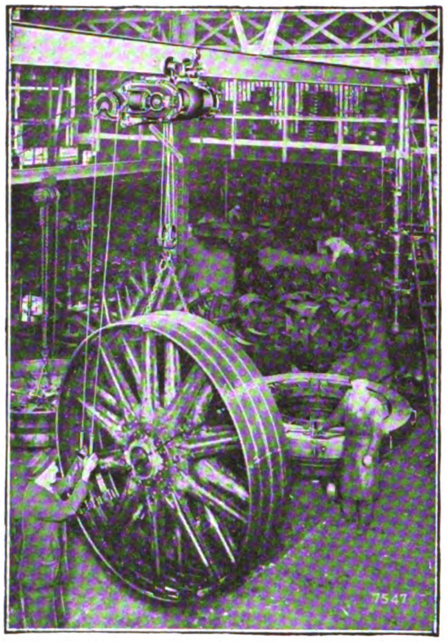
Among the interesting papers to be read at the Sixth Annual Safety Congress of the National Safety Council, to be held at the Hotel Astor, New York, September 11, 12, 13 and 14, the following papers will be of particular interest to the steel industry:

"Unsettled Accident Prevention Problems in Iron and Steel Industries," L. H. Burnett, assistant to president, Carnegie Steel Company, Pittsburgh, Pa.; "Analyses of Accidents," Dr. Lucian W. Chaney, United States Department of Labor, Washington, D. C.; "Fundamental Principles of Safeguarding," R. J. Young, manager Safety and Relief department, Illinois Steel Company, Chicago, Ill.; "The Relationship of Accident Surgery and Medical Service to Safety Work," Dr. E. M. Hagin, chief surgeon, Sharon Steel Hoop Company, Sharon, Pa.; "Safety in Yard Practices," F. G. Bennett, safety director, Buckeye Steel Castings Company, Columbus, Ohio; "Safe Practices in Sheet Mills," Frank E Morris, safety engineer, American Rolling Mill Company, Middletown, Ohio; "Open Hearth Hazards," Leslie M. Rice, district safety inspector, American Steel & Wire Company, Worcester, Mass.; "Safety and the Foreman," J S. Herbert, superintendent, Safety Department, Cambria Steel Company, Johnstown, Pa.

WITH THE EQUIPMENT MANUFACTURERS

MONORAIL ELECTRIC HOIST.

The Link-Belt Company, Chicago, Ill., announces that they are again able to furnish Link-Belt monorail electric hoists for quick shipment. Types C-1 and C-2 can be adapted for either direct or alternating current, and have a safe lifting capacity ranging from 1,000 pounds to 6,000 pounds.

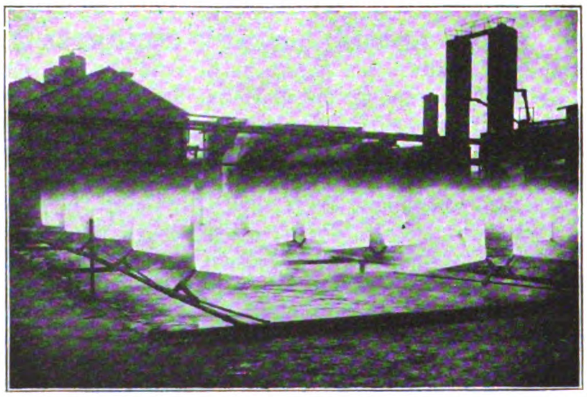


Link-Belt mono-rail hoist, lifting large pulley.

It is claimed that the Link-Belt hoist is the first mono-rail machine to employ a dynamic braking system for controlling the lowering speed. The hoist requires a small amount of head room. Automatic oil bath lubrication, and renewable bronze bushings are provided.

SPRAY COOLING SYSTEM.

The Star Brass Works, 114-20 Carroll avenue, Chicago, Ill., who have been continuously engaged in the manufacture of spraying machinery, pumps, and other specialties for the past 20 years, are now equipping many industrial plants in all sections of the country with their Spray cooling system for cooling recirculating water for condensers, water jackets, transformers, etc. The accompanying illustration represents a typical installation and it is claimed that by this system an average vacuum of 28 in. may be maintained the year around. The company supplies spray nozzles with instructions for the installing of same, or the complete system including nozzles and all fittings, as preferred.



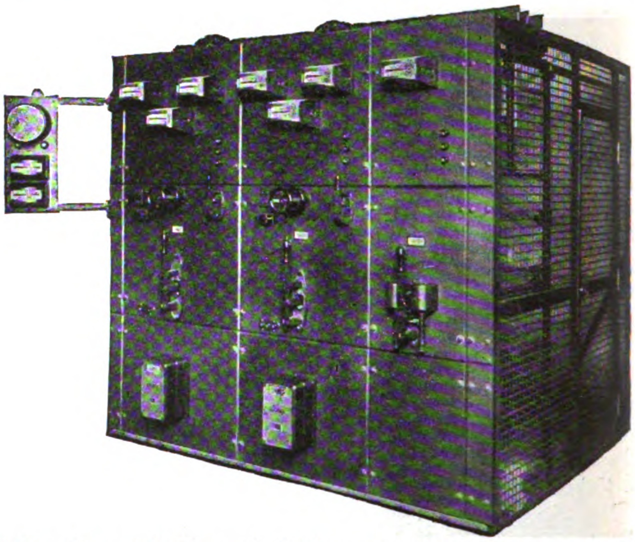
Spray cooling system, which it is claimed, can maintain a 28-in. vacuum.

SAFETY-FIRST SWITCHBOARDS.

One of the essential features of apparatus used for the control of electrical power is that it must afford a high degree of safety to any who may have occasion to handle such apparatus.

With the end in view of producing apparatus to meet "Safety-First" requirements, the General Electric Company, of Schenectady, N. Y., has developed two distinct types of switchboard equipment. One of these types is known as the removable truck type, and the other, the dead front type, is shown in the accompanying illustration. The applications of this equipment to power and lighting service are practically unlimited.

The removable truck type of switchboard has a particular application to industrial plants where continuity of service is of prime importance and where inflammable material is used extensively. All live parts are enclosed and entirely out of reach of the operator. All interior parts are accessible for repair or inspection only after the circuit has been opened by the opening of the circuit control device.



Safety-first switchboard, having no live parts accessible from the front of the board.

The dead front type of switchboard is for alternating current service and, as the name implies, no live parts are accessible from the front of the board. The back of the switchboard is enclosed in grille work with hinged doors on each side which are provided with locks so that only authorized persons holding the key may have access to the back of the board. This type of switchboard is for general power and lighting service on circuits up to 3,500 volts, 25 to 60 cycles.

DIAPHRAGM LIFT AND FORCE PUMP.

In order to meet the demand for a moderately priced compact pump good for a force of 15 feet and the ordinary diaphragm pump suction lift, the Goulds Manufacturing Company, of Seneca Falls, New York, have just placed upon the market their new No. 1687 diaphragm force pump. As a force pump it is especially desirable in that the pump can be placed in the trench or excavation and the water or sewage forced to the top.

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WITH THE EQUIPMENT MANUFACTURERS

MACHINE FOR BENDING HEAVY PLATES.

The Watson Stillman Company, 36 Church Street, New York, has brought out a new tool for use in shipbuilding, designed to bend heavy steel shapes for ship frames, deck beams, etc.

It is a very compact machine, built as light as is consistent with the work it is intended to do. The machine consists of a cylinder, ram and operating valve, mounted upon broad rollers so that it may be moved quickly over the bending slabs by handles at either side of the machine. It is thus possible to bend long members to template, without reheating and with a minimum of labor.

A loose pin is provided which fits into the holes in the bending slabs, and serves as an abutment for the machine. The ram is double acting, and its movement both forward and returning is under perfect control at all times. Provision is made to prevent overstroke. The illustration shows the machine equipped with a screw stem stop and release valve, but a single lever operating valve can be furnished if desired. Power may be supplied from a suitable pump or preferably from an accumulator service. The machine is built as shown with a movement at right angles to the axis of the ram, or in a direction parallel to it.

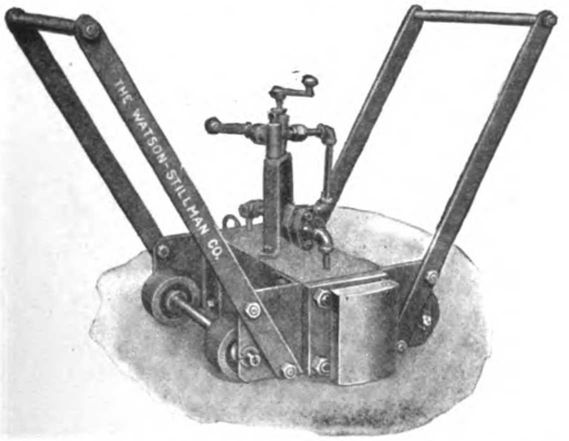


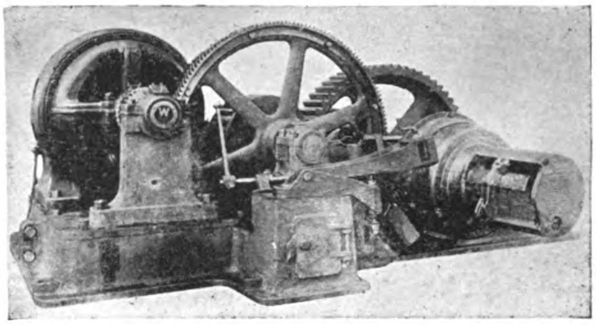
Plate bending machine equipped with handles to facilitate quick moving.

The machine illustrated has a ten inch stroke and develops eighteen tons at fifteen hundred pounds per square inch, and twenty tons at seventeen hundred fifty pounds per square inch pressure. It weighs 750 pounds.

MOTOR-DRIVEN BULL FRAME

For drawing wire of sizes from 7/16 in. to 1 in. diameter, the two-block horizontal spindle bull frame shown in the accompanying illustration is made by the Morgan Construction Company, of Worcester, Mass. It will handle square, hexagonal, and round sections, with pull at the die from 10,000 pounds to 20,000 pounds.

A special feature of this line of machines is a winding block so arranged that while the pull is always close to the main bearing, the coiled wire moves out to the end of the block in a regular helix without bunching or crowding. In addition to the safety afforded by the quick stoppage characteristic of individual drive, a friction clutch is contained in each block which instantly disengages the block from the mechanism. Thus by the movement of the clutch lever, the drawing may be stopped at any time regardless of the strain on the block.



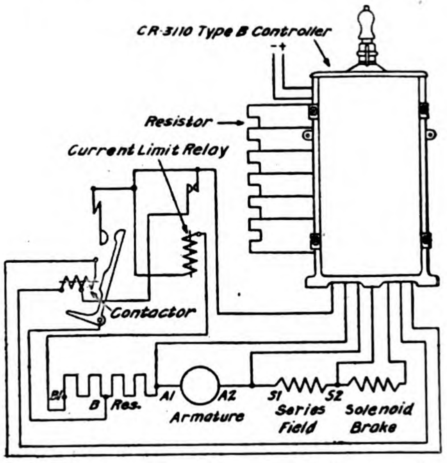
Motor-driven bull frame for drawing wire of sizes from 7/16 in. to 1 in. diameter

BRAKE CONTROL FOR CRANE HOISTS.

The General Electric Company has recently brought out an automatic device which can be added to their standard Type B drum controller and thus make a very serviceable semi-magnetic dynamic braking control for crane hoist service.

The additional equipment consists of: A panel for wall mounting which contains d. c. contactor and current limit relay. An extra resistance which is inserted in the circuit during the acceleration and deceleration period.

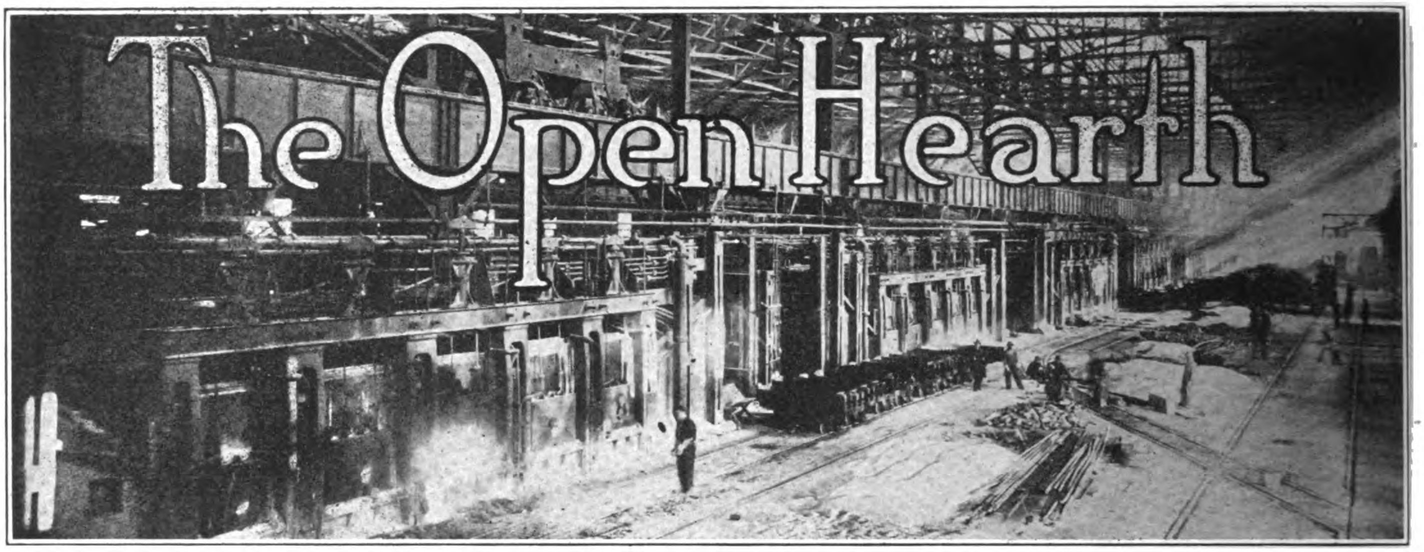
A dynamic braking, manually operated, drum type controller is more severe on the commutator of a direct current series motor than is a plain reversing manual controller, because, when lowering, the motor is connected similar to a shunt wound motor and does not have the inherent protection of the series field. In many installations where the service is severe, a semi-magnetic equipment will materially assist commutation. This equipment is useful also where the service is not quite severe enough to justify the expense of a full magnetic equipment.



Wiring diagram for dynamic braking controller, for crane hoist service.

SAFETY LAMP HANGER.

The Thompson Electric Company, Cleveland, Ohio, has placed on the market an interesting and serviceable safety disconnecting hanger for lamps suspended on posts. The device facilitates cleaning and repairing the lamps.



W. A. Janssen, for four years the superintendent of the Bettendorf Company Steel Foundry at Bettendorf, Iowa, has resigned, after having rounded out ten years of continuous service for this company. Mr. Janssen has served as chemist, metallurgist, superintendent of construction, assistant superintendent and superintendent, and has been a large factor in its building, having seen it grow from the bare acres to the largest single unit foundry in the country. He is well known to all foundrymen, being a vice president of the American Foundrymen's Association.

V V

Mr. Charles J. Barr, formerly general superintendent of the Ensley steel plant of the Tennessee company, will be the new general manager of the Fairfield works of the same company.

V V

Lincoln B. Patterson, formerly connected with the Emporium Iron Company, Emporium, Pa., has been made superintendent of the West End furnace of the Old Dominion Pig Iron Corporation, at Roanoke, Va.

V V

Mr. L. L. Carson, formerly vice president of the National Iron and Steel Publishing Company, has received a commission of first lieutenant in the National army.

V V

Charles C. Lynde, formerly Engineering Editor of The Blast Furnace and Steel Plant has received a commission of first lieutenant and has been assigned to duty in the National army, with the 306th engineers.

V V

Stewart C. Coey, formerly assistant superintendent of the electrical department of the Youngstown Sheet & Tube Company, Youngstown, Ohio, has resigned to become general superintendent of the Celluloid Company of America, operating a plant at Newark, N. J. His successor has not yet been appointed.

V V

R. B. Farquhar, who was assistant superintendent of the foundry at the Midvale Steel Company, in Philadelphia, is now superintendent of the Watertown Arsenal foundry.

V V

Harry A. Reichenbach, who has been efficiency engineer for the Bethlehem Steel Corporation, has resigned to accept a similar position with the Alpha Portland Cement Company, Easton, Pa.

V V

H. H. Henry has been placed in charge of the safety department recently established by the A. M. Byers Company, at its Girard, O., plant.

William C. Aldrich, formerly superintendent of the Penn Steel & Iron Company, Lancaster, Pa., has been made assistant general manager. J. O. B. Dellet has been made secretary to succeed J. Hale Steinman, now in the Federal service. W. F. Barry, formerly with the Portland Rolling Mill Company, Portland, Me., has been made superintendent.

V V

O. P. Ludwig, of Birmingham, Ala., has been named general manager of the reorganized Dayton Coal & Iron Company, Dayton, Tenn., and now is in active charge of the reconstruction work at the plant.

V V

Edward T. Edwards, Columbia, Pa., operating the East End Rolling Mills, has completed remodeling and improvement work at the Union Street rolling mill, recently acquired, and plans to place the plant in full operation at an early date.

V V

Thomas E. Durban, for 25 years general manager of the Erie City Iron Works, Erie, Pa., has resigned and will hereafter devote his time to his position as commissioner, representing boiler manufacturers of the country in behalf of the American Society of Mechanical Engineers Uniform Boiler Code, with offices in the Commerce building, Erie.

V V

Peter Blackwood has severed his connections with the Blackwood Steel Foundry Company, Springfield, Ohio. He has not yet announced his future plans.

V V

Fred G. Lange, formerly chief accident agent of the Youngstown Sheet & Tube Company, Youngstown, Ohio, has been appointed deputy safety inspector of the Ohio Industrial Commission. In his new capacity he will serve both as inspector and as instructor of deputies. He will be stationed at Columbus.

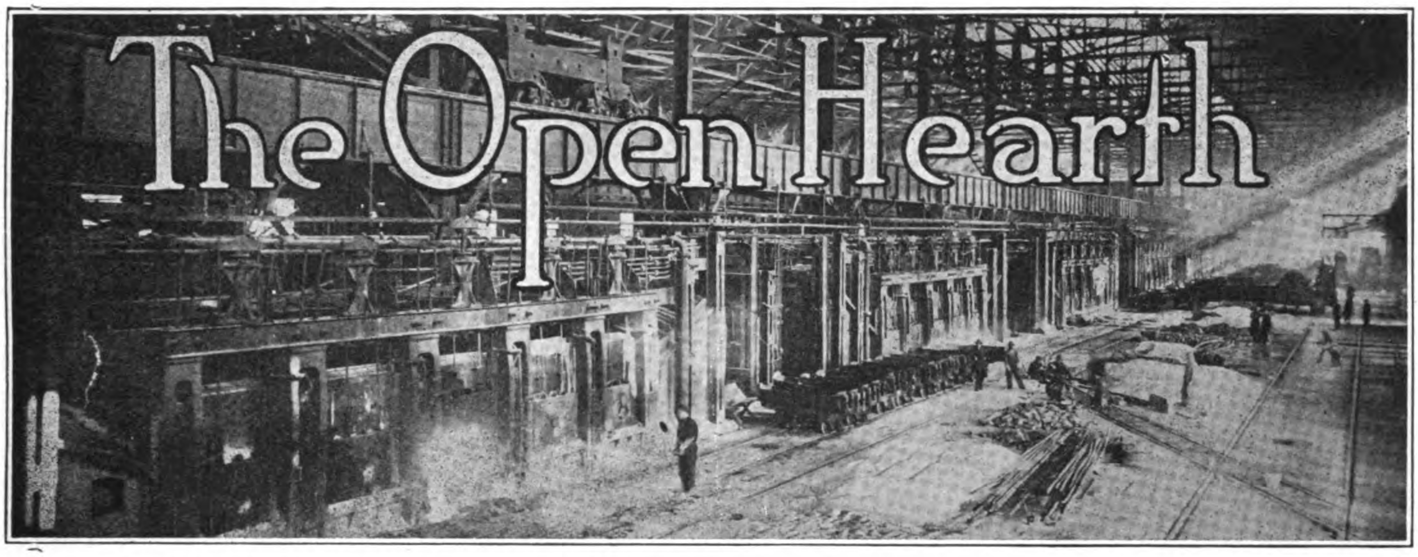
V V

Fred Coril ,formerly superintendent of the open hearth department of the Farrell, Pa., works of the Carnegie Steel Company, has resigned to accept a similar position with the Cambria Steel Company, Johnstown, Pa. Norman S. Powell, superintendent of the North Works open hearth, will succeed Mr. Coril at Farrell. Mr. Powell will be succeeded by Joseph Cooper.

V V

P. L. Williams has become superintendent at the works of the Empire Steel & Iron Company, Mt. Hope, N. J., succeeding H. M. Roche, who has become superintendent of the Wharton Steel Company, Dover.

The Open Hearth



Harry A. McKnight has resigned as superintendent of the plant of the American Car & Foundry Company, Jeffersonville, Ind., to enter the operating department of the Canadian Car & Foundry Company. He is succeeded at Jeffersonville by Charles T. Hertzsch, assistant superintendent of the plant.

V V

S. H. Chauvenet, formerly connected with the Robesonia and Sheridan blast furnaces in the Lebanon Valley, will be manager of the Island Park furnace, Easton, Pa., recently purchased by the Northern Ore Company, from the Thomas Iron Company.

V V

Maurice Langhorne, formerly with the Pulaski Iron Company, Philadelphia, is now connected with the Mining and Metallurgical department of the General Chemical Company, of New York.

V V

E. F. Entswile, formerly mechanical engineer of the Bethlehem Steel Company, Steelton, Pa., now is general superintendent of the Donaghmore plant at Lebanon, having succeeded W. L. Wolf, resigned. Frank E. Howells has succeeded Mr. Entswile as mechanical engineer of the Steelton plant.

V V

F. K. Bennett, rolling mill superintendent of the Tata Iron & Steel Company, Sakchi, Bengal, India, is in this country on a leave of absence, after three years' service at the Tata works.

V V

M. A. Neeland, who went to Russia early this year to make investigations in iron and steel lines for the American International Corporation, has returned to New York.

V V

G. C. Jones has resigned as metallurgical engineer of the Whiting Foundry Equipment Company, Harvey, Ill., to accept a position with the Huntingdon Steel Foundry Company, Huntingdon, Ind.

V V

B. A. Shutts, formerly of the North Cornwall furnaces, Bethlehem Steel Company, Lebanon, Pa., is now superintendent of the Central Iron & Steel Company, Harrisburg, Pa. Ira Hoover will succeed Mr. Shutts.

V V

John Lyman Cox, of the Midvale Steel Company, Philadelphia, Pa., has been appointed assistant to superintendent in charge of engineering and research.

R. A. Bull has resigned as vice president and general manager of the Chicago Steel Foundry Company, Chicago, to accept the position of vice president and general manager of the Duquesne Steel Foundry Company, Coraopolis, Pa.

V V

David N. Bradley has been appointed assistant superintendent of blast furnaces at Joliet Works, Illinois Steel Company.

V V

Frank I. Ellis, who was engaged by the Jones & Laughlin Steel Company, Pittsburgh, to design, build and put into operation a new mill at Woodlawn, Pa., has opened an office as a consulting engineer at 2126 Farmers bank building, Pittsburgh. For 12 years Mr. Ellis was chief engineer of the United Engineering & Foundry Company, Pittsburgh, and later was manager of the plant of the Mark Manufacturing Company, Chicago, at Zanesville, O.

V V

Edgar C. Felton, formerly president of the Pennsylvania Steel Company, has accepted an appointment as director of the department of civilian service and labor under the committee of the public safety, Philadelphia. In addition to being connected with various railroads and steel companies, Mr. Felton is now on the board of managers of the Girard Trust Company, director of the Franklin National bank, and the Farmers and Mechanics National bank.

V V

F. J. Ryan is now general manager of the Snyder Electric Furnace Company.

V V

W. S. Jones, of Philadelphia, who has been associated with the Midvale Steel Company, in its general sales department, has been chosen vice president of the Vanadium Alloys Company, of Pittsburgh and Latrobe, Pa.

V V

George Satterthwaite, superintendent, and Newell C. Bradley, assistant superintendent, of the Midvale Steel Company, Philadelphia, have resigned.

V V

J. P. Bennett, who was superintendent of the rolling mills of the Bethlehem Steel Company, has resigned and will be connected with the Keystone Steel & Wire Company, Peoria, Ill.

V V

Richard Crouch has resigned as superintendent of the merchant mill department of the Steelton plant of the Bethlehem Steel Company. He is succeeded by David Smith.

Some Pointers on By-Product Coke Oven Operations

DATA CONCERNING TYPICAL BY-PRODUCT COKE OVEN INSTALLATION.*

The by-product coke oven, of the LaBelle Iron Works, Steubenville, Ohio, consists of two batteries of 47 ovens each of H. Koppers cross regenerative ovens consisting of a narrow brick chamber approximately 38 ft. long, 10 ft. high, 18 in. wide. This chamber or oven has a capacity of about 16 tons of coal, giving a 70 per cent yield of coke of about 2¼ tons in 18 hours. It will thus require about 2,000 tons of coal every 24 hours. To supply this amount of coal, we have three sources, one from standard railroad cars, one from barges at the river dock, one from storage stock pile. When coal is used from railroad cars direct, the car is placed over a large bin or track hopper and the coal allowed to drop out into the hopper. When coal is taken from barges, it is hoisted by a five-ton clamshell bucket with a hoisting speed of 600 ft. per minute, driven by a 350 horsepower 3-phase, 60-cycle, 440-volt slip ring motor on a traveling coal tower or unloader. The hoist has dynamic breaking in two phases for lowering. The coal is hoisted approximately 80 ft. and the trolley with the bucket is brought over stationary bins at the coal dock by a 75-horsepower slip ring motor. The bucket is opened and the coal is dropped into bins from which it is conveyed by rubber belt conveyors to the track hopper or bins. The main conveyor of about 150 feet is driven by a 50-horsepower, 220-volt induction motor, controlled by an operator at the track hopper. This coal unloader has a capacity of 2,000 tons in 10 hours.

When coal is not available from the railroad cars or barges, the coal is taken from the stock pile by No. 2 coal tower and loaded into standard railroad cars, which are then pulled over the track hopper as in first case by a 50-horsepower direct-current car spotter. The coal is put into stock by No. 2 coal unloader, which takes the coal from six bins along a 950 ft. stocking pit, the coal being dropped from standard railroad cars into these bins. The unloaders have a 360 deg. swing, which allows them to completely fill the pits. The current is delivered to the coal unloaders by three 60-pound American standard gauge track rails, supported in a triangle by third rail insulators, average center of rails 17 in. The rails are tapped every 50 ft. to three alternating current 60-cycle, 440-volt, three-phase, feeders paralleling collector rails. The rails are supported on 8 in. by 8 in. posts, 7 ft. 6 in. from ground. The feeders are supplied from an outdoor transformer station, consisting of three 250-k.v.a., 22,000-volt to 460-volt single phase, oil cooled transformers. The coal is carried from track hopper by a conveyor, driven by 10-horsepower motor, which delivers it to another conveyor driven by 75 horsepower motor, which carries the coal to a breaker in top of building approximately 90 ft. high. The breaker is driven by a 50--horsepower slip-ring belted motor. From the breaker it passes over a mixing conveyor to a conveyor driven by 5-horsepower motor to hammer mill bins, from which it passes to hammer mills driven by a 350-horsepower slip-ring motor. The coal passes from the hammer mills on to belt conveyor driven by a 50-horsepower motor, which lifts it up to another conveyor driven by a 25-horsepower induction motor which delivers it in top of storage bin over ovens. All coal and coke conveyor feeders, hammer mills and breaker controllers are placed in a brick building and so interlocked that if any conveyor, feeders, etc., stop from any cause all the conveyors back of it stop and all ahead of it keep on running, thus preventing the coal from piling upon a dead conveyor. In order to get protection for underload due to pinion coming off, a wattmeter type relay was installed which drops out the switches if load falls below a predetermined value. All motor windings were impregnated to prevent acid and coke dust from destroying insulation. The motors in coke screen house were enclosed in a metal cabinet, which in turn was placed in a concrete room.

The coal is taken from the storage bin in a larry or coal charging car, driven by a 30-horsepower direct-current mill motor, the current being supplied by collector rails mounted on asbestos molded blocks to stand heat of oven. The car travels over tops of ovens and drops coal into same through four openings. When the coal is coked and ready to be pushed, the door on the back of the oven is removed by an electrically-driven door machine and the door on the front is removed by a coke-pushing machine, and the ram of the machine is started through the oven pushing the coke ahead of it into a quenching car on the other side of oven. The ram is driven by a 50-horsepower direct-current mill motor The bridge motion and ram motion are so interlocked that the bridge cannot be moved while the ram is in motion.

The quenching locomotive has two 85-horsepower direct current, 220-volt motors, arranged for series parallel operation and is equipped with air compressors for operating brakes and opening and closing doors on quenching cars. The quenching station is equipped with a 35-horsepower induction motor for pumping water into spray tank, and is automatically operated by float in tank. The coke wharf feeders that feed coke from wharf on to conveyors are driven by a 5-horsepower induction motor.

The coke conveyor to screens is driven by a 25-horsepower induction motor. The screens are each driven by a 15-horsepower induction motor. The empty cars are spotted and the full ones removed by a coke car spotter, driven by a direct-current 50-horsepower mill motor with magnetic control, which has dynamic breaking on first point. The spotter consists of a drum and gear which pull a steel cable attached to cars. In order that the gas may be reversed in the ovens at regular intervals and in proper cycle, an automatic controller operated by a clock has been installed. The motors opening the valves can be operated either by the clock electrically or by hand electrically or mechanically. The ovens being on one side of the Ohio river and the blast furnaces on the other, a cantilever type railroad bridge was built connecting the two plants. The gas from the ovens is sent under the river by a 250-horsepower direct-current variable speed motor-driven booster to the heating furnaces.

All circuits were run with three-conductor, 400,000 C. M. lead covered cables under ground with pot heads at substation. The power is purchased from a power company who have two 22,000-volt lines at our sub-station, reducing voltage to 2,200 from outdoor transformer station. The substation at coke works is connected to power house at Steubenville by a submarine cable and an over-head line over the railroad bridge at 22,000 volts, being stepped down to 2,200 at each station. The Steubenville power house will operate in parallel with the purchased power.

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* Abstract of paper read by Mr. Jas. Farrington at a meeting of the Association of Iron and Steel Electrical Engineers.

PRODUCTION OF PIG IRON IN THE UNITED STATES IN THE FIRST HALF OF 1917.

HALF-YEARLY OUTPUT OF PIG IRON BY STATES.

HALF-YEARLY PRODUCTION OF ALL KINDS OF PIG IRON.

States.	Blast furnaces.				Production—Gross tons. (Includes spiegeleisen, ferro-mang., ferro-silicon, ferro-phosphorus, etc.)		
	In blast Dec.31, 1916.	June 30, 1917.					
		In.	Out.	Total.	First half of 1916.	Second half of 1916.	First half of 1917.
Massachusetts	1	1	1	2	4,700	1,019	4,305
Connecticut	1	2	1	3			
New York	18	21	6	27	1,214,037	1,138,498	1,118,482
New Jersey	1	4	1	5			
Pennsylvania	127	136	25	161	8,286,076	8,220,208	7,790,514
Maryland	4	4	1	5	243,895	257,557	234,589
Virginia	9	12	8	20	202,777	197,108	231,937
Georgia	0	0	4	4	....	....	....
Texas	0	0	2	2			
Alabama	29	34	14	48	1,366,728	1,396,157	1,494,479
West Virginia	4	4	0	4	268,859	285,731	282,548
Kentucky	4	4	3	7			
Mississippi	0	0	1	1			
Tennessee	11	12	6	18	162,009	193,365	201,296
Ohio	65	72	5	77	4,250,790	4,352,105	4,269,708
Illinois	24	22	2	24	1,938,152	1,984,360	1,810,137
Indiana	10	12	0	12	1,073,768	1,147,940	1,200,122
Michigan	12	12	2	14			
Wisconsin	5	6	2	8	417,542	393,783	392,864
Minnesota	3	3	0	3			
Missouri	2	2	0	2	190,189	247,444	227,254
Iowa	0	0	0	0			
Colorado	3	4	2	6			
Oregon	0	0	1	1			
Washington	0	0	1	1			
California	0	0	0	0			
Total	333	367	88	455	19,619,522	19,815,275	19,258,235

HALF-YEARLY PRODUCTION OF COKE PIG IRON.*

New York	18	21	2	23	1,214,037	1,138,498	1,117,918
New Jersey	1	3	1	4			
Pennsylvania	112	122	16	138	8,205,199	8,080,729	7,586,452
Maryland	4	4	0	4	243,895	257,557	234,589
Virginia	9	12	6	18	202,777	197,108	231,937
Georgia	0	0	2	2			
Texas	0	0	1	1			
Alabama	28	32	13	45	1,346,460	1,377,223	1,475,063
West Virginia	4	4	0	4	268,859	285,731	282,548
Kentucky	4	4	3	7			
Tennessee	10	11	6	17	161,128	191,944	200,874
Ohio	65	72	5	77	4,250,790	4,351,438	4,269,708
Illinois	24	22	2	24	1,938,152	1,984,360	1,810,137
Indiana	10	12	0	12	1,150,364	1,202,824	1,263,426
Michigan	3	3	0	3			
Wisconsin	4	5	1	6			
Minnesota	3	3	0	3	366,274	429,251	402,028
Missouri	1	1	0	1			
Iowa	0	0	0	0			
Colorado	3	4	2	6			
Washington	0	0	1	1			
Oregon	0	0	1	1			
California	0	0	0	0			
Total	303	335	62	397	19,347,935	19,496,663	18,874,680

*Includes ferro-alloys made with electricity.

ANTHRACITE AND MIXED ANTHRACITE AND COKE PIG IRON.

New York	0	0	3	3	79,591	138,197	203,320
New Jersey	0	1	0	1			
Pennsylvania	12	12	6	18			
Total	12	13	9	22	79,591	138,197	203,320

HALF-YEARLY PRODUCTION OF CHARCOAL PIG IRON.

Massachusetts	1	1	1	2	4,700	1,019	4,305
Connecticut	1	2	1	3			
New York	0	0	1	1			
Pennsylvania	3	2	3	5	1,286	1,282	1,306
Maryland	0	0	1	1	......	......	......
Virginia	0	0	2	2			
Alabama	1	2	1	3	20,208	18,934	19,416
Georgia	0	0	2	2	881	2,088	422
Texas	0	0	1	1			
Tennessee	1	1	0	1			
Mississippi	0	0	1	1			
Ohio	0	0	0	0			
Michigan	9	9	2	11	132,637	127,986	124,618
Wisconsin	1	1	1	2	32,224	29,106	30,168
Missouri	1	1	0	1			
Total	18	19	17	36	191,996	180,415	180,235

TOTAL PRODUCTION OF PIG IRON ACCORDING TO FUEL USED.

Coke*	303	335	62	397	19,347,935	19,496,663	18,874,680
Anthracite†	12	13	9	22	79,591	138,197	203,320
Charcoal	18	19	17	36	191,996	180,415	180,235
Total	333	367	88	455	19,619,522	19,815,275	19,258,235

* Includes ferro-alloys made with electricity
† Includes mixed anthracite and coke pig iron.

HALF-YEARLY OUTPUT OF PIG IRON BY GRADES.

HALF-YEARLY PRODUCTION OF BASIC PIG IRON.

States.	First half of 1916.	Second half of 1916.	First half of 1917.
New York, New Jersey	573,244	632,596	535,286
Pennsylvania—Allegheny County	2,309,777	2,167,298	1,797,309
" —Other counties	2,578,396	2,328,799	2,330,237
Virginia, Alabama, Kentucky	501,225	686,685	770,667
Ohio	1,199,267	1,257,609	1,412,324
Indiana, Illinois	1,416,246	1,451,455	1,466,677
Michigan, Wis., Minn., Missouri, Colorado	251,930	329,560	308,104
Total	8,830,085	8,854,002	8,620,604

HALF-YEARLY PRODUCTION OF BESSEMER AND LOW-PHOSPHORUS.

New York, New Jersey	223,456	229,564	224,345
Pennsylvania	2,566,539	2,966,468	2,943,671
Maryland	227,652	241,343	214,652
West Virginia, Kentucky, Tenn., Ala	236,182	260,406	249,427
Ohio	2,377,073	2,556,158	2,235,910
Illinois, Wisconsin, Minnesota, Colorado	1,208,275	1,329,341	1,173,421
Total	6,839,177	7,583,280	7,041,426

HALF-YEARLY PRODUCTION OF FOUNDRY PIG IRON AND FERRO-SILICON.

Massachusetts, Connecticut	4,700	1,019	4,305
New York, New Jersey	331,651	193,951	271,555
Pennsylvania	559,767	427,447	417,088
Maryland, Virginia, West Virginia	192,454	196,764	236,549
Kentucky	43,151	40,929	29,617
Tennessee	132,264	172,983	187,068
Alabama	824,867	668,506	701,886
Ohio	465,106	322,091	330,402
Indiana, Illinois	91,742	60,296	58,844
Michigan	199,600	180,397	176,142
Wisconsin	165,155	146,292	143,258
Minnesota, Missouri, Iowa, Col., Wash.	75,953	56,559	45,734
Total	3,086,410	2,467,234	2,602,448

HALF-YEARLY PRODUCTION OF MALLEABLE PIG IRON.

New York	74,298	76,011	77,806
Pennsylvania	58,415	52,989	38,176
Kentucky, Ohio	139,682	146,498	205,098
Indiana, Illinois, Michigan, Wis., Mo.	188,444	185,149	188,902
Total	460,839	460,647	509,982

HALF-YEARLY PRODUCTION OF FORGE PIG IRON.

New York, New Jersey	6,780	3,112	3,607
Pennsylvania	54,807	91,081	98,910
Virginia	16,103	*4,364	2,147
Tennessee, Kentucky	1,366	1,588	1,643
Alabama	19,570	15,380	17,156
Ohio	70,680	72,241	75,451
Total	169,306	179,038	198,914

* Credit. Due to change in grade

HALF-YEARLY PRODUCTION OF SPIEGELEISEN AND FERRO-MANGANESE.

N. Y., N. J., Pa., Md., Ala., Ill., Col., Wash. Cal.	189, 46	226,488	210,432*
Total	189,046	226,488	210,432*

* 130,965 gross tons ferro-manganese and 79,467 tons spiegeleisen.

HALF-YEARLY PRODUCTION OF OTHER GRADES.

New York, New Jersey	2,108	3,264	3,388
Pennsylvania	8,586	11,639	8,803
Md., Virginia, West Va., Tenn., Alabama	27,984	23,353	13,164
Ohio	5,006	4,261	10,523
Indiana, Ill., Mich., Wis., Minn., Missouri, Col., Wash., California	975	2,069	38,551
Total	44,659	44,586	74,429

PIG IRON MADE FOR SALE OR FOR USE OF MAKERS IN THE FIRST HALF OF 1917.

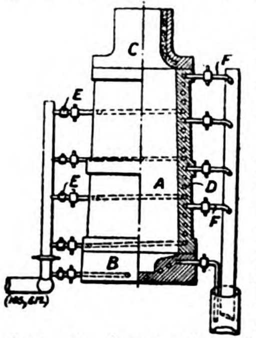
Grades.	For sale.	For maker's use.	Total Gross tons.
Basic	1,312,529	7,308,075	8,620,604
Bessemer and low phosphorus	1,103,327	5,938,099	7,041,426
Foundry, including ferro-silicon	2,548,789	53,659	2,602,448
Malleable	509,946	36	509,982
Forge or mill	58,154	140,760	198,914
Ferro-Manganese	46,802	84,163	130,965
Spiegeleisen	53,229	26,238	79,467
All other grades	52,013	22,416	74,429
Total	5,684,789	13,573,446	19,258,235

Submitted by the American Iron and Steel Institute.

RECENT PATENTS

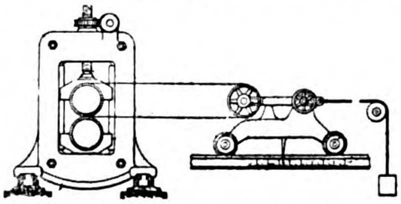
Ingot Mold.

105,617. Sir W. G. Armstrong, Whitworth & Company, Ltd., and H. H. Ashdown, Newcastle-upon-Tyne. Casting steel ingots. This invention relates to the casting of ingots of large size. According to this invention, ingots of large size are cast in a mould having a cooling medium circulating in its walls in such a manner that the sides of the ingot are quickly cooled and the segregates are driven into the center of the ingot. A is a mold having a bottom plate B, and in the mold plate are pipes D for the circulation of the cooling medium, the supply to the various pipes being controlled by a series of cocks E. The cooling medium is discharged from the pipes D by pipes F. The metal is fed to the mold through a feeding head C of usual construction. In casting the ingot, the metal is poured through the feeding head C, and the cocks E are opened as the metal rises in the mold, the central portion of the ingot being kept liquid until the last by the metal in the feeding head. This patent was reported in "Engineering."



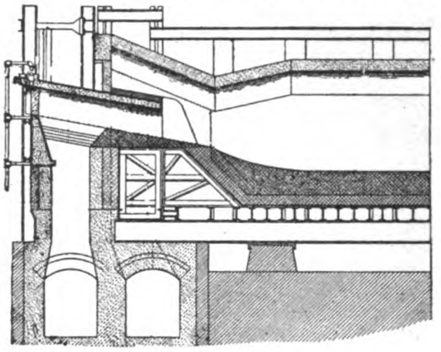
Rolling Mill.

1,233,647. William C. Coryell, Youngstown, Ohio. This patent has reference to a mill for rolling endless articles, including a roll having an overhung work-engaging surface, an overhung member for engaging the loop of material being worked upon, and a movable frame to support the loops formed by the endless material being rolled.



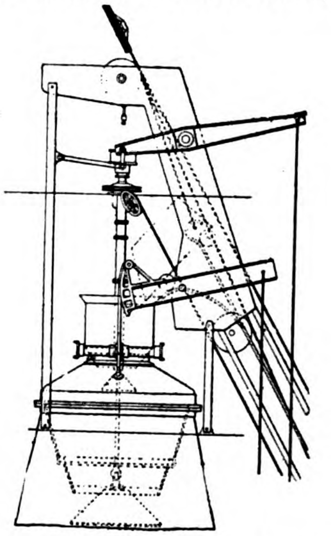
Open Hearth Furnace.

1,236,140. Thomas S. Blair, Jr., Chicago, Ill., assignor to Blair Engineering Company, New York, N. Y. The patent comprises an open hearth furnace having a basic bottom, gas and air uptakes at its ends, blocks extending upward and toward the ends of the furnace from the hearth line and provided with longitudinal channels for the gas-ports, a hollow water-cooled port-covering overlying the top of the ports and depending on the two sides thereof and presenting its bare metal surface to the gas throughout the length of the ports and on the top and two sides thereof and protecting the material of the block from the destructive action of the flame. The bulk head has an inclined surface to collect and hold slag particles.



Blast Furnace Top.

1,234,630. George L. Collord, Sharpsville, Pa., assignor to Blast Furnace Appliances Company, Cleveland, Ohio. The object of this patent is to obtain a more even distribution of stock in a blast furnace. The bell is alternately rotated in one direction and then in another. The charging receptacle is rotated during two out of three of the intervals between successive emptyings, such rotation being first in one direction and then in the opposite direction. The device is operated by steam cylinders, the steam lines and reversing valves for which are included in the patent.

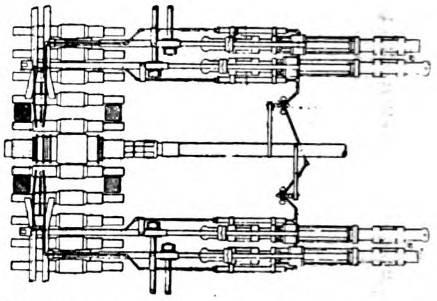


Repairing Open Hearth.

106,376. The Clyde Furnace Company, Limited, and W. Dixon, Glasgow. The object of the invention is to provide an improved method of repairing burned-out cavities in open hearth while the furnace is working.

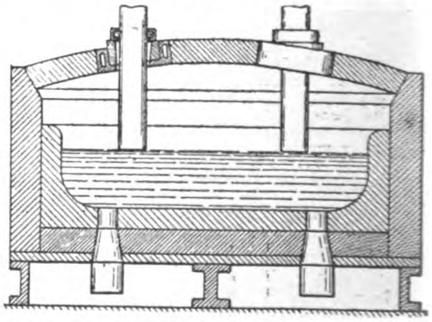
Cooling Rolls.

1,234,899. Charles W. Hawthorne, Buffalo, N. Y., assignor to United Engineering & Foundry Company, Pittsburgh, Pa. This invention brings out a new idea for cooling the rolls in a rolling mill. As shown on the accompanying illustration, water supply pipes are attached to the manipulators. The stream from the pipes is directed particularly against the pass which is in use. The pipes which are carried both above and below the table rolls shift with the manipulators. Telescopic supply connections are included in the patent, as well as a governor, actuated by the driving connections for the rolls, which controlls the water supply. The supply of water is automatically cut off from the pipes at one side of the rolls and delivered to the pipes at the other side of the rolls upon each reversal of the mill.



Electrode Packing for Furnace.

1,234,946. Martin Sperling, Essen-on-the-Ruhr, Germany, assignor to Fried Krupp, Aktiengesellschaft, Essen-on-the-Ruhr, Germany. The patent refers to electric furnaces, and comprises a fluid cooled annular member rigidly secured in the roof of the furnace having an inwardly projecting flange and a liner of insulating material. The liner and flange each have a central opening of greater diameter than that of the electrode. There is a tight-fitting packing ring around the electrode, which is suspended from the top of the liner so as to permit movement of the electrode. The packing ring consists of an outer metallic casing and a core of insulating material.



Steel Plant Incorporations and Construction

Milliken, Staten Island, N. Y. — The Downey Shipbuilding Corporation, 120 Broadway, New York, recently organized with a capital of $10,000,000 to take over the plant of Milliken Brothers, Inc., structural steel works, and establish a shipbuilding plant, is having plans prepared for the erection of a series of six new machine shops and other buildings. Wallace Downey is president.

Buffalo, N. Y. — The Wickwire Steel Company is building a new rod, nail and blooming mill addition to its plant.

Harrison, N. J. — The Crucible Steel Company will build two additions to its plant on South Fourth street, to cost about $75,000.

Harrison, N. J. — The Driver-Harris Company, manufacturers of wire, will build a new one-story foundry addition to their plant on Middlesex street, to cost about $25,000.

Newark, N. J. — The Federal Shipbuilding Company, recently incorporated by interests connected with the United States Steel Corporation, with capital of $3,000,000, has secured property on the Kearny meadows, consisting of about 75 acres of land, and plans for the erection of a large shipbuilding plant.

Trenton, N. J. — The American Steel & Wire Company will build a one-story addition to its machine shop on Hamilton avenue, about 50x70 feet.

Trenton, N. J. — The Trenton Malleable Iron Company is planning for the erection of a new two-story shop addition, about 30x150 feet.

Lebanon, Pa. — The Lebanon Valley Iron & Steel Company is arranging for the installation of new electric operating equipment at its plant.

Milwaukee, Wis. — The Globe Seamless Steel Tubes Company, F. J. O'Brien, superintendent, contemplates extensions to cost about $100,000.

Chicago, Ill. — The Midland Electric Steel Company recently has been chartered with $10,000 capital, by Joseph S. Samuels, Stanley Filip and R. I. Davis.

Wilmington, Del. — The Wilmington Steel Company, Third and Herald streets, a subsidiary of the Midvale Steel Company, Widener building, Philadelphia, plans to rebuild its plant recently damaged by fire. Loss, $150,000.

South Bethlehem, Pa. — The Bethlehem Steel Company, will soon award the contract for a one-story, 65x200-foot factory. Estimated cost $200,000.

Watervliet, N. Y.—The Ludlum Steel Company has had plans prepared by T. W. Price, Woolworth building, New York City, for an addition to its plant. E. Corning, president.

Norristown, Pa. — The Malleable Iron & Steel Company plans to build a new plant here.

Pottstown, Pa. — The Pottstown Steel Plate Products Company is building a plant. S. R. Morris, treasurer.

Murphysboro, Pa. — The Harrison Steel Company is building a steel casting foundry. Estimated cost $300,000. J. W. Harrison, president.

Hamstramock, Mich. — The Swedish Crucible Steel Company will build a factory. Estimated cost $8,000.

East Youngstown, O. — The Youngstown Sheet & Tube Company has awarded the contract for a new mill.

Youngstown, O. — The Republic Iron & Steel Company has awarded the contract for two open hearth furnaces. J. W. Dietrick, vice president.

Milwaukee, Wis. — The Globe Seamless Steel Tubes Company, Thirty-seventh and Burnham street, has awarded the contract for several additions to its plant. Estimated cost $100,000. F. J. O'Brien, general manager.

Duluth, Minn. — The Duluth Iron Works has awarded the contract for its foundry.

Seattle, Wash. — The Olympic Steel Works, 5200 Ninth avenue, has had plans prepared for a 73x102-foot foundry. Estimated cost, $6,000.

Birmingham, Ala.—The United States Steel Corporation contemplates an expenditure of $11,000,000 at its plant here.

Wierton, W. Va. — The Phillips Sheet & Tin Plate Company, Frick building, plans to build several mills.

Chicago, Ill. — The Illinois Steel Company, 208 S. LaSalle street, has awarded the contract for a one-story steel mill to be built at Eighty-sixth and Mackinay streets. Estimated cost, $100,000.

Duluth, Minn. — The Duluth Iron Works, Polk street, will build an addition to its plant. Estimated cost $18,000.

Indianapolis, Ind. — Industrial Electric Furnace Company; $500,000. Incorporators: Charles B. Sommers, Charles B. Fletcher, F. von Schiegell, F. T. Snyder and S. A. Fletcher. The company will operate its factory in Indianapolis for the manufacture of electric furnaces. The main offices will be in Chicago.

Albany, N. Y. — The Seneca Electric Furnace Corporation has been incorporated for the purpose of manufacturing and selling electric furnaces for steel making and other purposes. Thornton W. Price is vice president and general manager and Edwin Corning is treasurer. The New York office of the company is located in the Woolworth building.

New York, N. Y. — Sussex Iron & Steel Company; $1,000,000. To manufacture and sell and deal in and with steel, copper, nickel, etc.

Seattle, Wash. — Smelter Steel Company; $1,500,000. Corwin S. Shank, incorporator.

Wilmington, Del. — Tennessee Manganese Company; $300,000. To manufacture iron, steel, etc.

New York, N. Y. — The United Steel & Metal Corporation has been incorporated with a capital of $100,000, to engage in the manufacture of iron, steel and other metal products. A. Heller, F. Viethardt and M. Sternberg, 906 Broadway, are the incorporators.

Lorain, O. — National Tube Company plans the erection of a benzol plant at this place. Benzol will be made from the 308 by-product coke ovens at the plant.

Stamford, Conn. — The Stamford Iron & Steel Company has been incorporated with $10,000 capital, by Paul V. Hoyler, Albert C. Smith and George G. Hammill.

Wilmington, Del. — The All-Steel Wheel Company has been organized with $200,000 capital, to manufacture wheels. F. R. Hansell, J. Vernon Pimm and S. C. Seymour, Camden ,N. J., are the incorporators.

Toledo, O. — The Lewis Steel Products Company has been chartered with $100,000 capital, by Charles S. Northrup, Oscar J. Smith and others.

Buffalo, N. Y. — The H. G. Trout Company, Ohio street, manufacturers of castings, etc., will build a new blacksmith shop 40x50 feet, and foundry, 50x85 feet, to cost $18,000.

Maurer, N. J. — The American Smelting & Refining Company, 120 Broadway, New York, will build a new four-story mill addition, 55x60 feet, at its local works.

Philadelphia, Pa. — The Midvale Steel Company, Widener building, is taking bids for the construction of a two-story shop addition, 46x130 feet, at its Nicetown works.

Beaufort, S. C. — The American Shipbuilding & Dock Corporation, recently incorporated, is planning for the construction of a shipbuilding plant on property recently acquired on the Beaufort river. R. C. Horne, Jr., is president.

Pittsburgh, Pa. — The Pittsburgh Steel Products Company is planning a new plant, including a new town on the Monongahela river. It is planned to expend about $3,000,000. Several farms in Allen township, opposite Fayette City, were purchased some time ago. A battery of blast furnaces, tube mills and other departments will be installed. The plant will have a river frontage of three miles. The president of the company is Willis F. McCook, of Pittsburgh.

Trade Publications

Painting Equipment.—The Spray Engineering Company, Boston, Mass., have issued a bulletin describing the Spraco pneumatic painting equipment.

Electric Hoisting Machinery.—The Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., has issued a very complete and comprehensive catalogue giving description and data concerning their electric hoists. Outlined dimensioned, drawings giving complete clearance are included. Bulletin M-1, issued by the same firm describes and gives dimensions of light capacity hoists, which are manufactured in a large variety of types and sizes ranging in capacity from 500 pounds to 60,000 pounds.

Ingersoll-Rand Booklets.—The following new forms have just been issued by the Ingersoll-Rand Company, New York: Form 8006—20-page catalog on Imperial motor hoists and stationary motors. Form 8212—4-page bulletin on Crown coal pick and core breaker. Form 8213—16-page booklet on "Little David" pneumatic chipping, calking and scaling hammers. Form 9102—8-page bulletin on air receivers, pressure tanks and moisture trays. Catalogs are illustrated, and show tables of sizes and capacities.

Electric Furnace. — The Booth-Hall Electric Furnace Company, Chicago, Ill., has issued a folder describing their electric furnaces for the melting and refining of steel and other ferrous and nonferrous metals, also for smelting ores.

Roller Chains.—The Link-Belt Company, Chicago, Ill., has issued two new bulletins, one describing the Link-Belt roller chain standard equipment for tractors and trucks. The other entitled "Some Facts About Roller Chain Drives," relates the experience of a large user of this product.

Hoists.—A pamphlet has been received from the Wright Manufacturing Company, Lisbon, O., entitled, "Wright Hoist," which contains interesting data concerning the high speed or spur geared hoist, standard screw hoist, and the differential block manufactured by this company. Tables and illustrations serve to make the booklet of particular value.

Pyrometer.—"Hoskins High Resistance Pyrometers," is the title of a new booklet published by the Hoskins Manufacturing Company, of Detroit, Mich., which is devoted to a discussion of the advantages of high resistance meters, factors causing variation in external resistance, meter calibration; and to a description of the Hoskins recording pyrometer and the Hoskins thermocouple.

Steel Heat Treatment.—The Stroh Steel Hardening Process Company, of Pittsburgh, Pa., describes the Stroh process of treating steel in a new booklet recently issued by that concern. The Stroh process is a method for casting the finest alloy steel, together with ordinary soft steel in one solid piece.

Grab Buckets. — The Blaw-Knox Company, Pittsburgh, Pa., have recently issued a folder describing the "Blaw Bulldog" buckets. Capacity and dimensions of buckets are also presented.

Electric Hoists. The Barber Foster Engineering Company, Cleveland, Ohio, has issued a Bulletin 5-H, describing their mono-rail hoists.

Heating Furnaces.—An interesting catalog describing English heating furnaces and accessories, including blast pipe connections, blowers, etc., has been received from Alldays & Onions, Birmingham, England.

Book Reviews

The Iron Ores of Lake Superior. By Crowell and Murray. 316 pages 5¾ by 9 inches. 17 illustrations including colored geological maps of ore ranges. Published by the Penton Press Company, Cleveland, Ohio. Third edition.

The book should be of great interest to miners and users of Lake Superior ore, inasmuch as interesting data relative to mines has been brought up to date. The production, valuation and beneficiation of ores are discussed, and much practical data is included.

How to Make High-pressure Transformers. By F. E. Austin, 46 pages, 4½ by 7⅛ inches; 21 illustrations. Second edition. Published by Prof. F. E. Austin, Box 441, Hanover, N. H. Price, 65 cents.

The work deals with the theory of making high pressure transformers. It is written particularly for the experimenter who desires to make his own apparatus. The illustrations serve as a valuable guide in constructing the transformers. The data and principles brought out in this work would be of valuable assistance to any engineer.

Examples in Battery Engineering. By F. E. Austin. 90 pages, 4¾-in. x 7½-in. 39 illustrations. First edition. Published by Prof. F. E. Austin, Box 441, Hanover, N. H Price $1.25.

Quoting the author the book "Treats of all kinds of primary and storage cells and their application in practise. Many illustrations show clearly how to make battery connection for all kinds of service, from automobiles to submarines." The book deals with the subject in a practical, logical, and systematic manner.

Compressed Air for the Metal Worker. By Charles A. Hirschberg. 315 pages, 5⅛ by 8¼ inches. 294 illustrations. First edition. Published by the Clark Book Company, New York, N. Y.

The practical uses of compressed air in power plants, foundries, machine shops, and boiler and structural shops are described and explained in an interesting and decidedly practical manner. Little space is devoted to the theory of compressed air. Valuable data is presented, and numerous interesting illustrations serve to make the work both easy to comprehend and interesting. From the practical standpoint, this book very ably covers the uses of compressed air.

Society Meetings

American Chemical Society, Boston, September 10-15.

National Safety Council, New York, September 10-11.

National Association of Stationary Engineers, Evansville, Ind., September 10-15.

National Exposition of Safety and Sanitation, New York City, September 10-15.

Association of Iron and Steel Electrical Engineers, Philadelphia, Pa., September 10-14.

The Sixth Annual Safety Congress and Exposition, Hotel Astor, New York, September 11-14.

American Institute of Metals, Boston, Mass., September 24-29.

American Foundrymen's Association, Boston, Mass., September 24-29.

Third National Exposition of the Chemical Industries, Grand Central Palace, New York, September 24-29.

American Electro-Chemical Society, Pittsburgh, Pa., October 3-6.

American Institute of Mining Engineers, St Louis, October 8-13.

Annual Congress of the National Association of Purchasing Agents, Pittsburgh, William Penn Hotel, October 9-11.

American Gas Institute, Washington, D .C., October 16-19.

Fall session of the American Iron and Steel Institute, Hotel Sinton, Cincinnati, October 26-27.

American Society of Mechanical Engineers, New York City, December 26-29.

American Mining Congress State Chapter, Phoenix, Ariz., December 26-29.

Trade Notes

John T. Wilkin has been elected president of the Connersville Blower Company, Connersville, Ind., in addition to his duties as engineer.

On account of the growing business of the Phillips Sheet & Tin Plate Company in the Detroit territory, the company has deemed it necessary to open an office at 2032 Dime Savings Bank building, Detroit Michigan.

A. W. Ransome, who for nearly twenty years has been closely indentified with the development and manufacture of concrete machinery, has joined with the Blaw-Knox Company.

The New York office of the Shepard Electric Crane & Hoist Company, has been moved from 50 Church street, to 30 Church street. An export department has also been located at this office.

Announcement has been made of the merging of the Columbus Iron & Steel Company, with the American Rolling Mill Company. Middletown, Ohio.